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AUTHORITY

AFCCC ltr, 4 Apr 2006

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CHARTS OF MAXIMUM AND MINIMUM THICKNESS LINES 1000/500 MB, NORTHERN HEMISPHERE

1946-50

These charts were prepared by Dr. R. C. Sutcliffe of the Meteorological Office, Dunstable, England.

Construction of the envelopes.

To construct the envelopes of a specific thickness line of the 1000/500-mb layer for a month, e.g., 18,000 feet for October, the 18,000-ft line was taken from the morning thickness chart for each day in the month of October during the years 1946 through 1950. All these thickness lines (31 X 5 = 155 of them) were plotted on a chart and the southern (minimum) and northern (maximum) envelopes were determined.

Similarly envelopes for other specific thickness lines have been determined for each month. They have been chosen at 600-ft intervals, so that the thickness lines mapped are 19,200 (highest), 18,600, 18,000, 17,400, 16,800, 16,200, 15,600, and 15,000 ft. (lowest). All the minimum envelopes for a month have been entered on a chart and the maximum envelope for the month on a separate chart. A set of 2 X 12 = 24 charts will then represent the result of the investigation.

On some of the minimum charts isolated cold pools occur south of the main envelope encircling the pole. For practical reasons only one chart a day (the morning chart) was chosen to represent the position of the thickness line during the whole day. At the time of the map a "cut-off" low might have formed, whereas earlier, not represented maps might have shown a cold tongue protruding south from the main cold reservoir and thus bridged the gap between the main envelope and the isolated pool of the same denomination. It is, however, also possible that such a bridge never existed. This is equivalent to saying that the cold pool was not advected south but formed or partly formed locally through adiabatic cooling and/or nonadiabatic processes (radiation, cooling by precipitation, evaporation).

Similarly is explained the existence of cut-off warm pools north of the same-valued main envelope encircling the globe.

It will be noticed that some envelopes have discontinuities. These arise from the inhomogeneous series of charts from which the lines are derived. Hemispheric charts were not available throughout the period Oct. 1946 - Sep. 1951. In some regions of the hemisphere the lines are based on a shorter period than the major part of the chart. Consequently the minimum lines will in some cases jump further north on entering such a region and the maximum lines will jump further south. The discontinuities in the data period are marked on the envelopes by a stroke and the extent of the limited data period is indicated.

Use of the Charts.

As thickness lines are also isopleths of mean temperature (meaned over logarithmic pressure) in an isobaric layer, we can say that the maximum and the minimum charts represent the extremes of the mean temperature in the layer 1000/500 mb.

Notice how the minimum envelopes are made up of sections of cyclonically-curved thickness lines, while the maximum charts are made up of sections of anticyclonically-curved thickness lines. This confirms the well-known principle that cold air masses aloft arrive on a cyclonically-curved path while warm air masses are advected on an anticyclonic path.

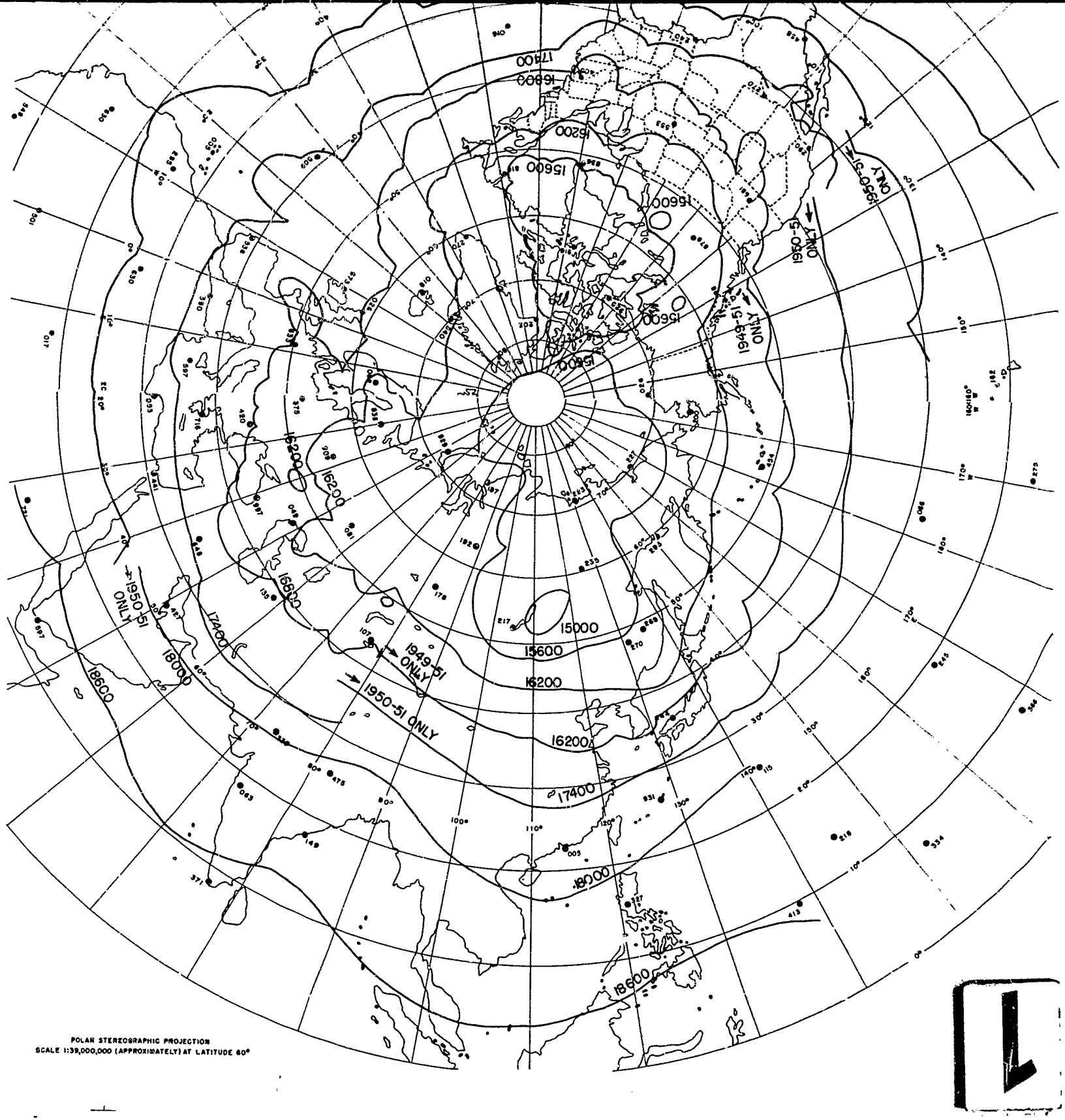
The charts can be used as a check on the positions of thickness lines or on the values of the thicknesses, in both analysis and forecasting: In analysis as check on radiosonde data and for estimating thicknesses in areas of sparse upper-air data. When we know the mean and extremes of a quantity we are in a better position to estimate its value than without any quantitative knowledge. The probability that the extremes will be exceeded is small, less than approximately 1/150, since each chart is based on approximately 150 days. How closely the extremes will be approximated depends on the intensity of the cold, or warm, outbreak respectively. The intensity is inferred from the proximity and the temperature of the source region in combination with the speed of the air flow into the area of interest. With some experience a satisfactory accuracy can be obtained in judging this relationship.

In constructing prognostic upper-air maps the thickness charts are an indispensable aid in eliminating hydrostatic inconsistencies. It is here immaterial whether the 500-mb surface is built up from a prognostic 1000-mb surface and a prognostic 1000/500 thickness chart, or the 1000-mb chart is built down from a prognostic 500-mb chart and a prognostic thickness chart, or the prognostic 500-mb and 1000-mb charts are constructed independently and then mutually adjusted by means of a thickness chart. In any case the thickness chart forms the necessary connecting link between the two pressure levels.

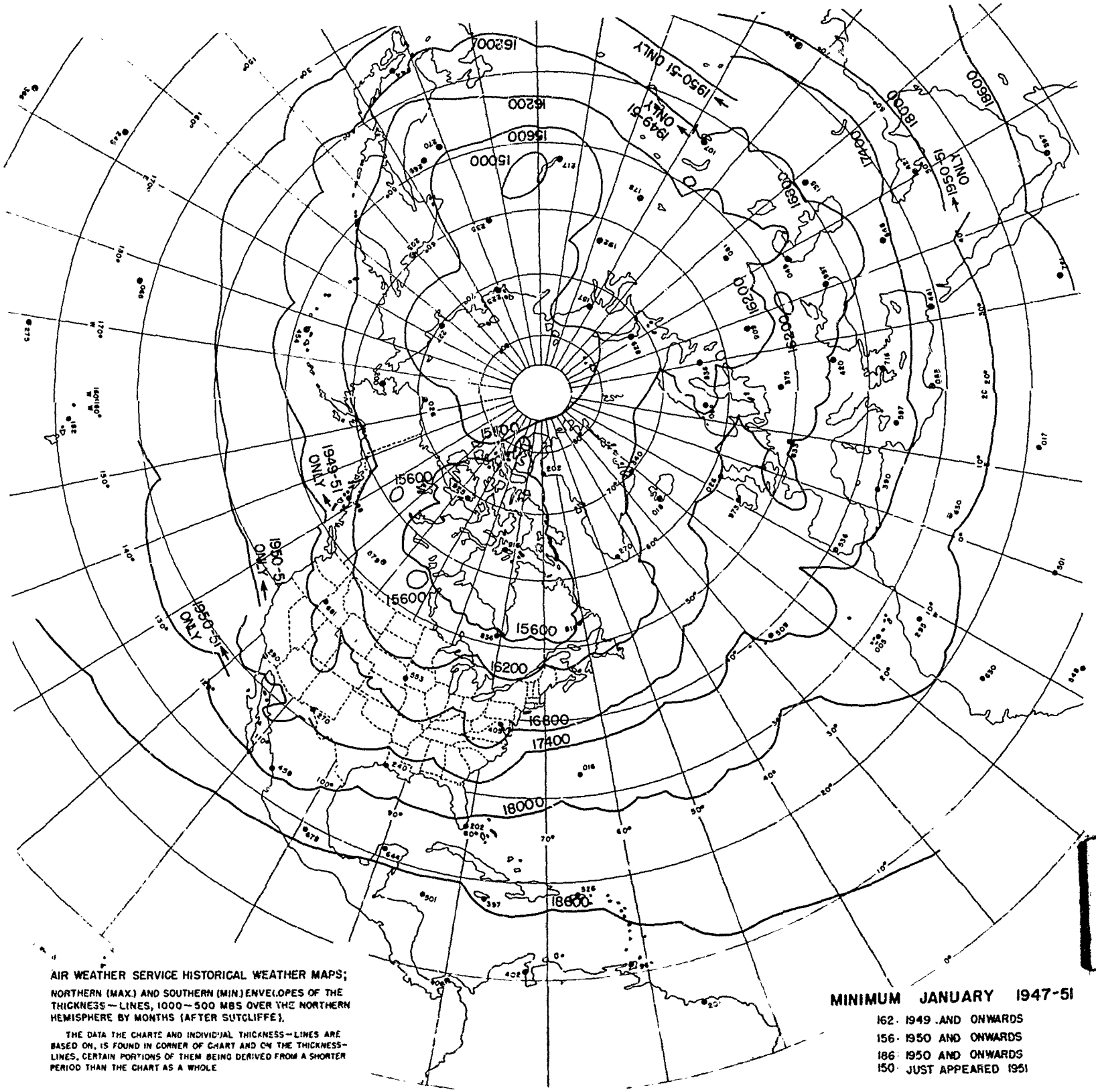
Notice how the minimum lines crowd over the warm ocean currents near the east coast of the continents in wintertime, illustrating the rapid warming of the cP air masses as they leave the continent.

Also notice how in the winter the cold sources in the Arctic tend to split into two pools, one with center over Siberia near 110°E and another over the Canadian Arctic Archipelago near Hudson Bay. Thus the charts teach us something of the principal air mass sources and about modification of air masses.

The period on which the charts are based (up to 5 years) is comparatively short. The lines therefore do not have a smoothed appearance but are made up of sections of individual thickness lines, marking the occasion of an extreme outbreak of cold air or extreme advection of warm air. The charts therefore give information about historical extreme cases and how they are related to topography, distribution of land and sea, proximity of cold and warm sources etc.



POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°



AIR WEATHER SERVICE HISTORICAL WEATHER MAPS;

NORTHERN (MAX.) AND SOUTHERN (MIN.) ENVELOPES OF THE THICKNESS — LINES, 1000 — 500 MBS OVER THE NORTHERN HEMISPHERE BY MONTHS (AFTER SUTCLIFFE).

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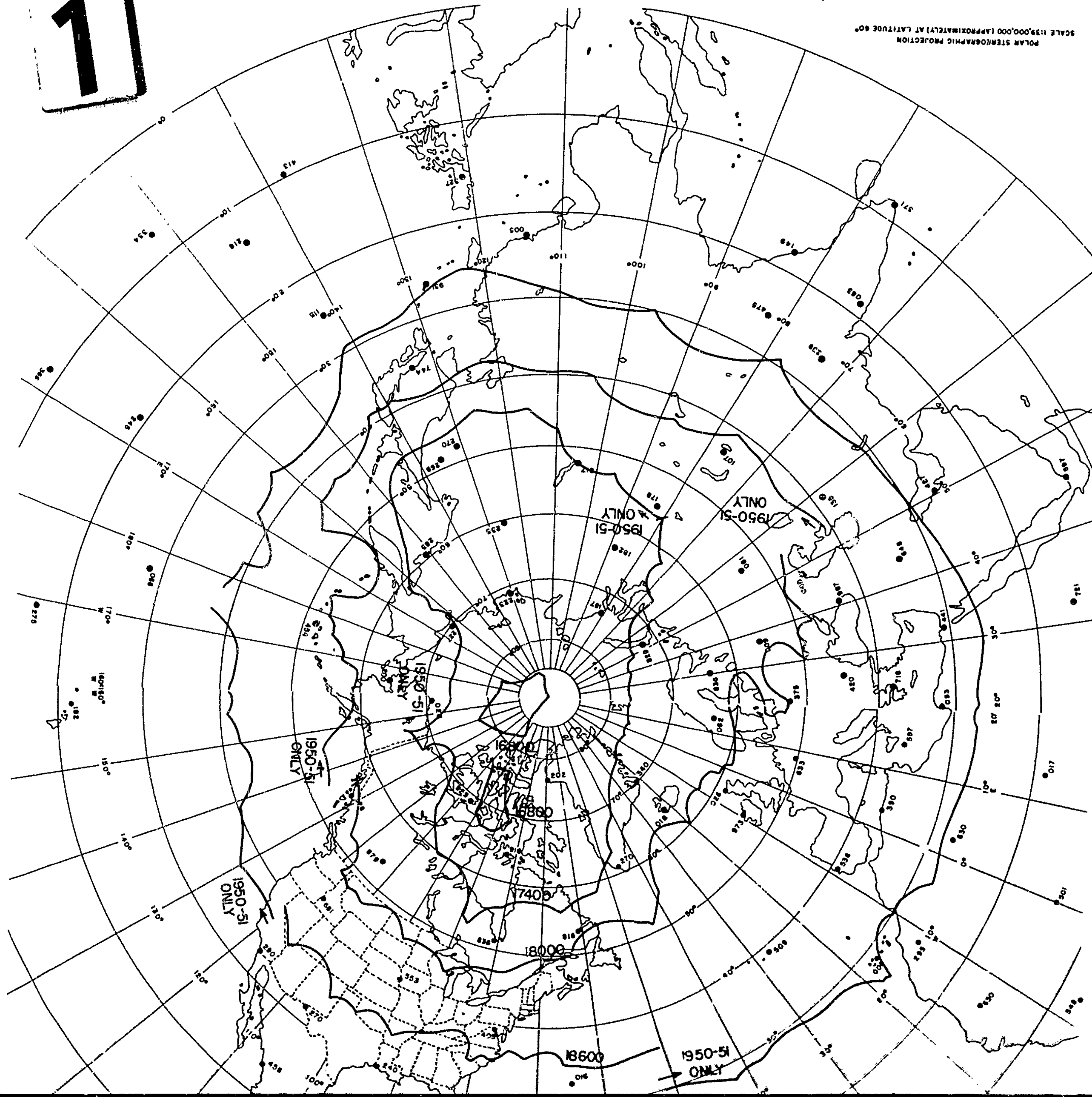
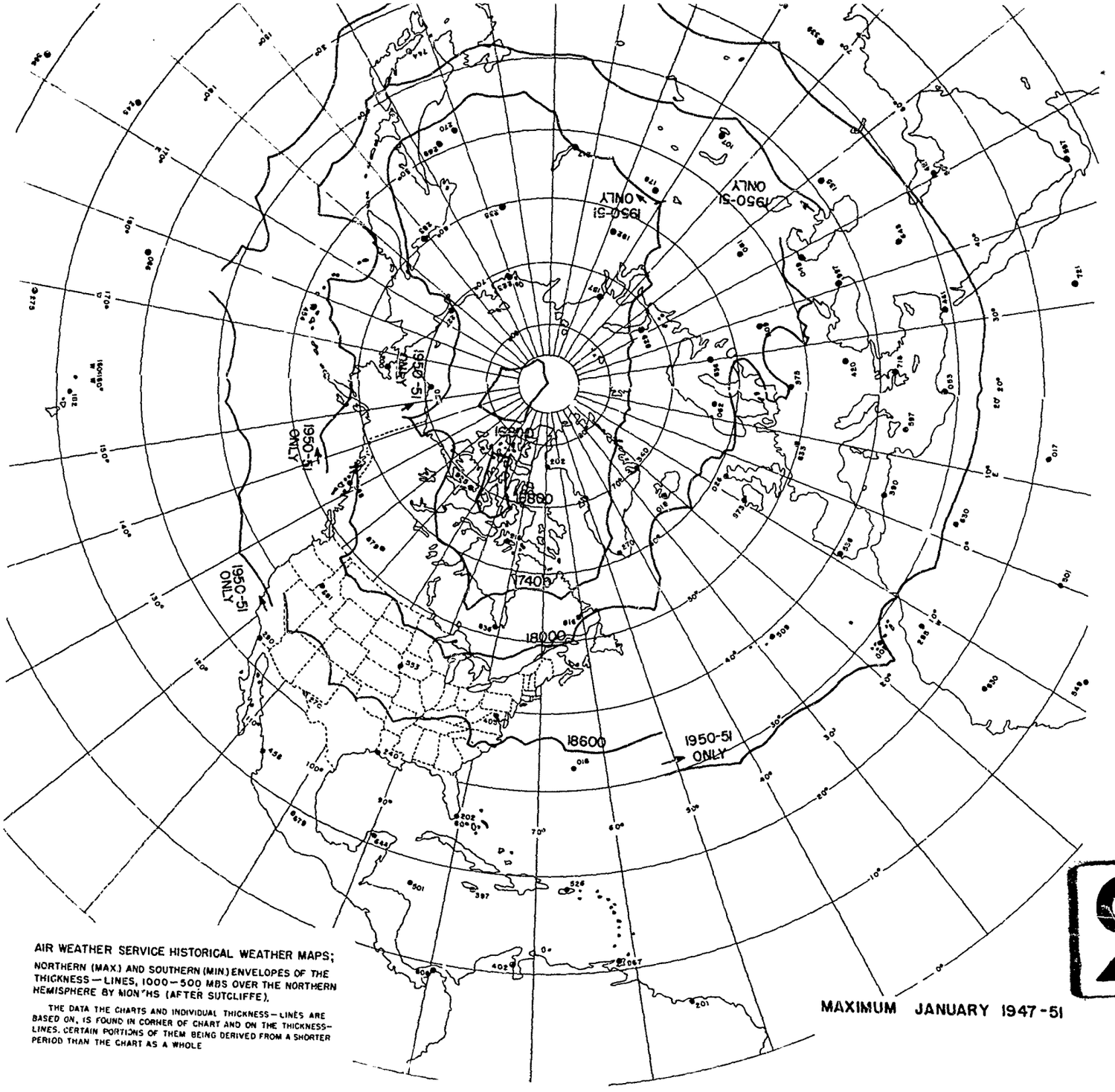
MINIMUM JANUARY 1947-51

162 · 1949 AND ONWARDS
156 · 1950 AND ONWARDS
186 · 1950 AND ONWARDS
150 · JUST APPEARED 1951

2

1


POLAR STEREOGRAPHIC PROJECTION
SCALE 1:35,000,000 (APPROXIMATELY) AT LATITUDE 60°
18600
18000
17400
16800
16800
1950-51 ONLY
1950-51 ONLY
1950-51 ONLY
1950-51 ONLY
1950-51 ONLY
1950-51 ONLY



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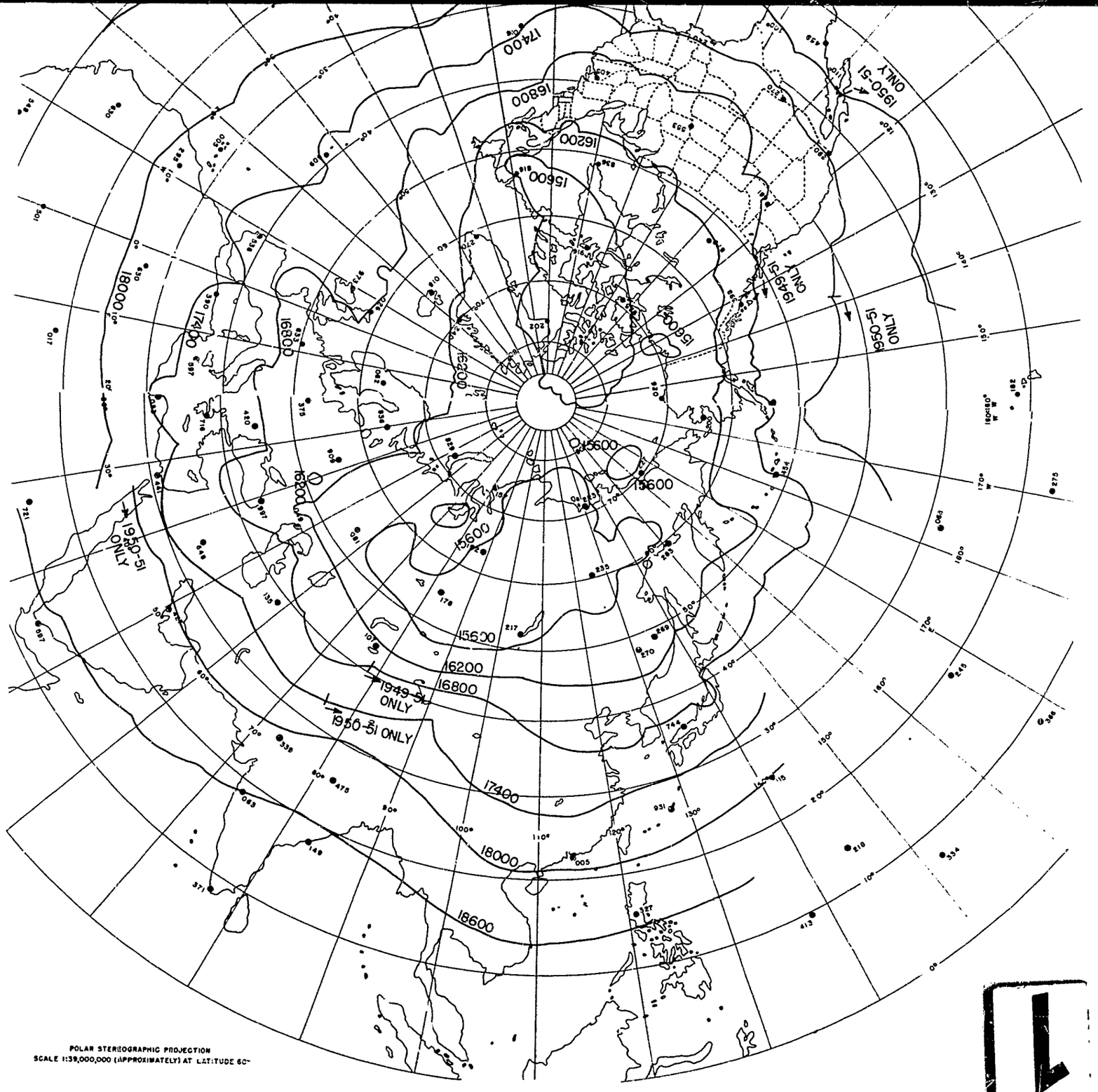
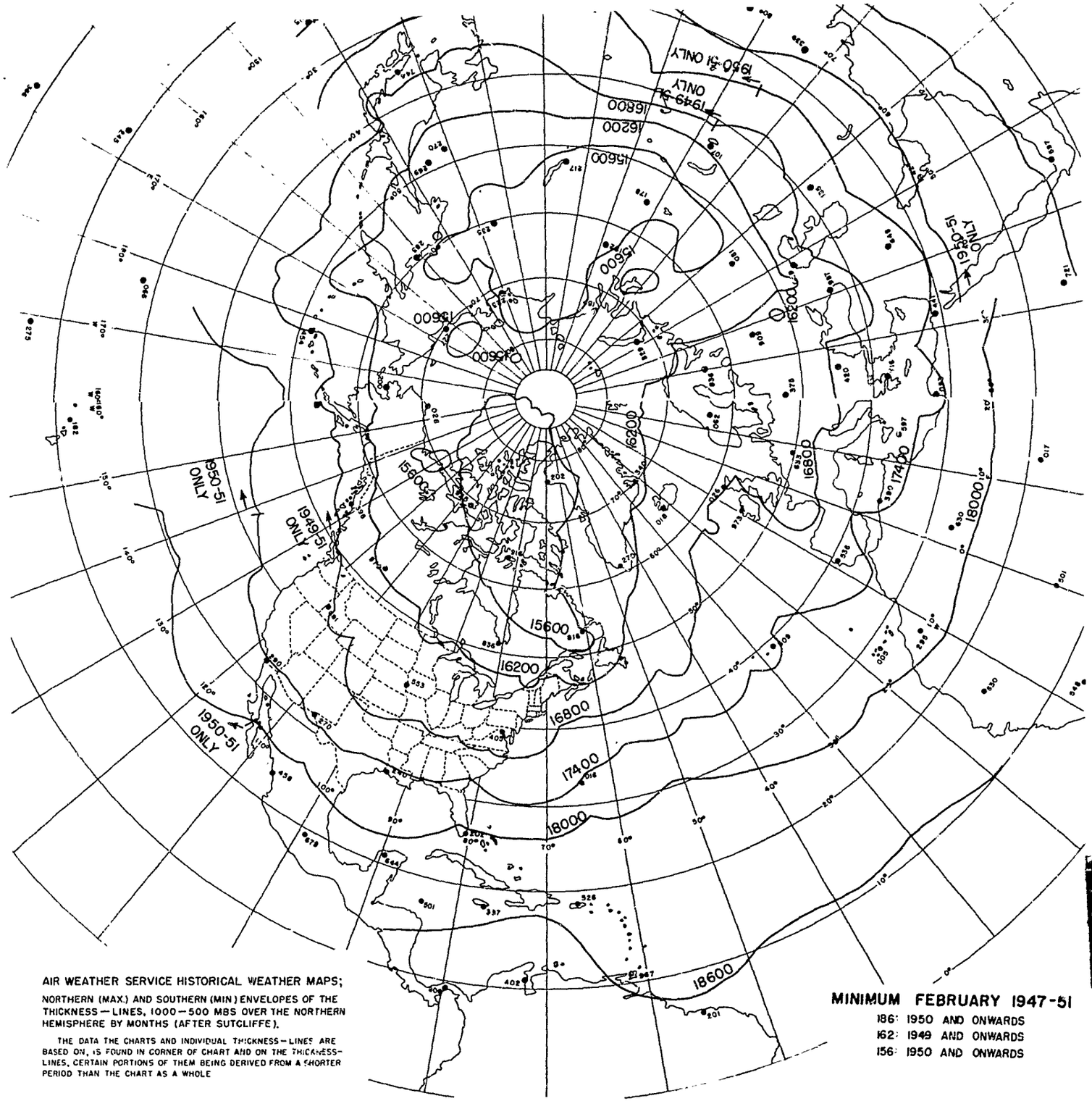
2

MAXIMUM JANUARY 1947-51


17400
16800
16200
15600
18000
18600
1950-51 ONLY
1949-51 ONLY
1950-51 ONLY
1949-51 ONLY
1950-51 ONLY
POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°

1



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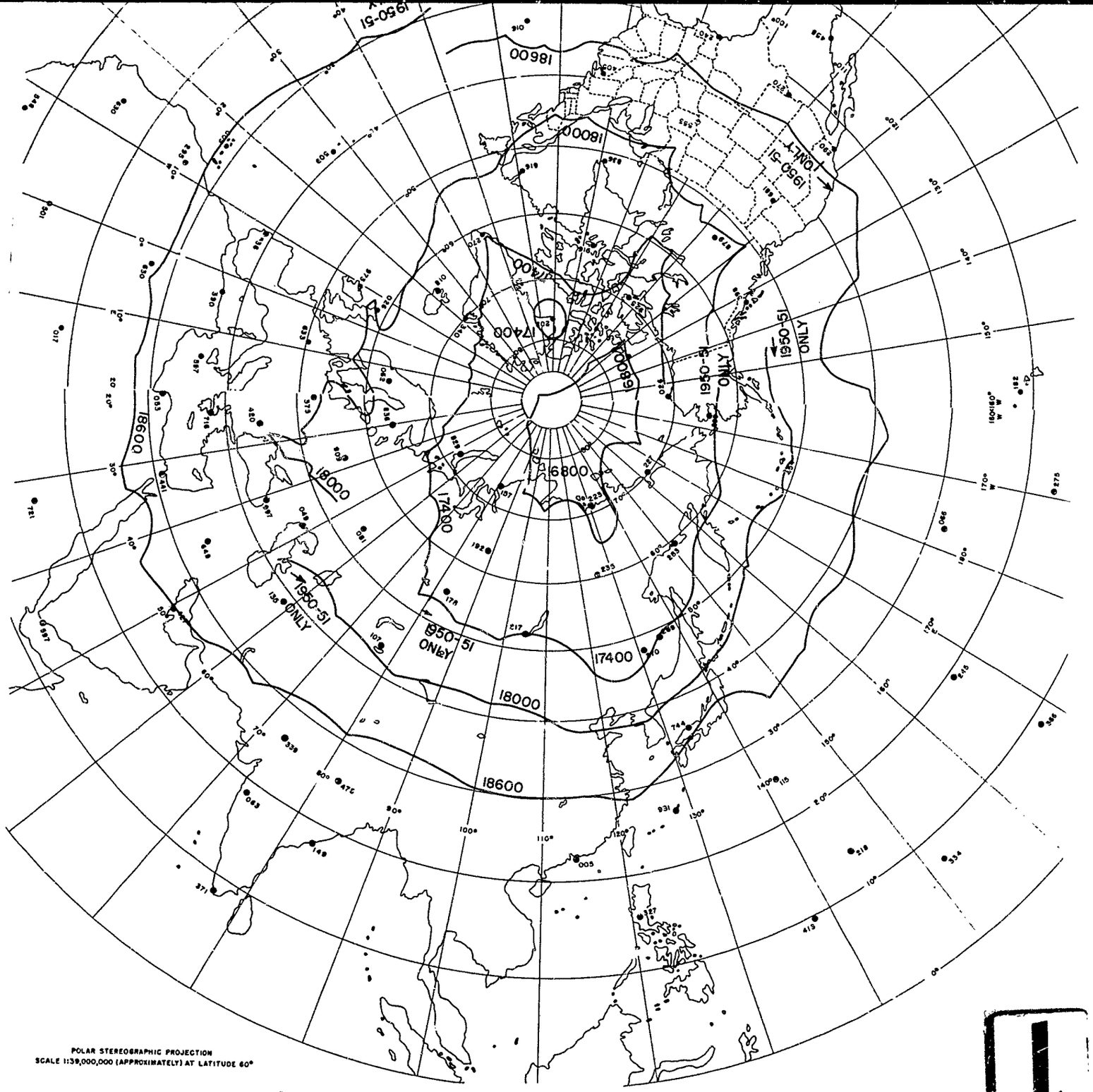
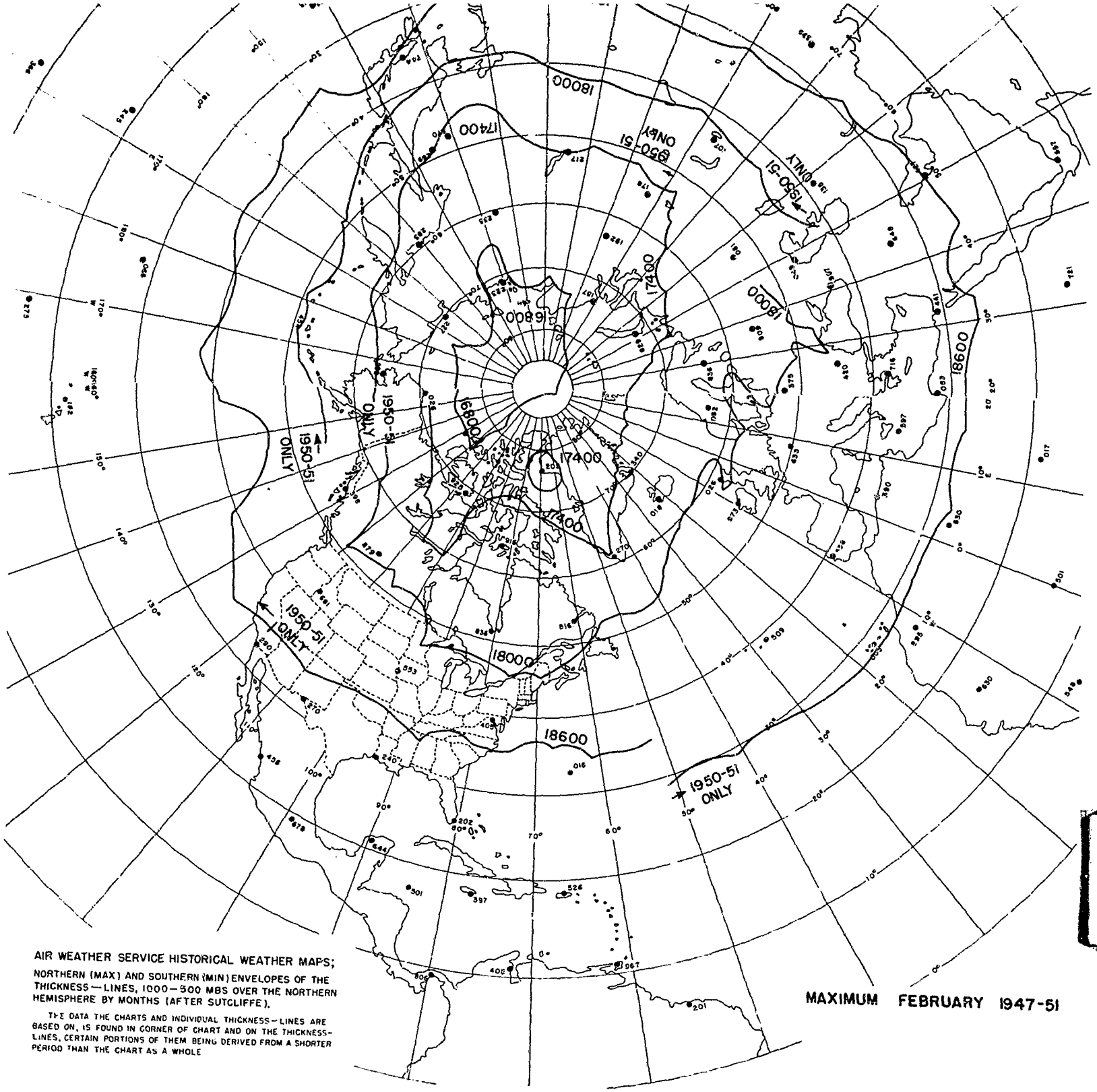
MINIMUM FEBRUARY 1947-51

186: 1950 AND ONWARDS
162: 1949 AND ONWARDS
156: 1950 AND ONWARDS

2


18600
18000
17400
16800
1950-51 ONLY
POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°



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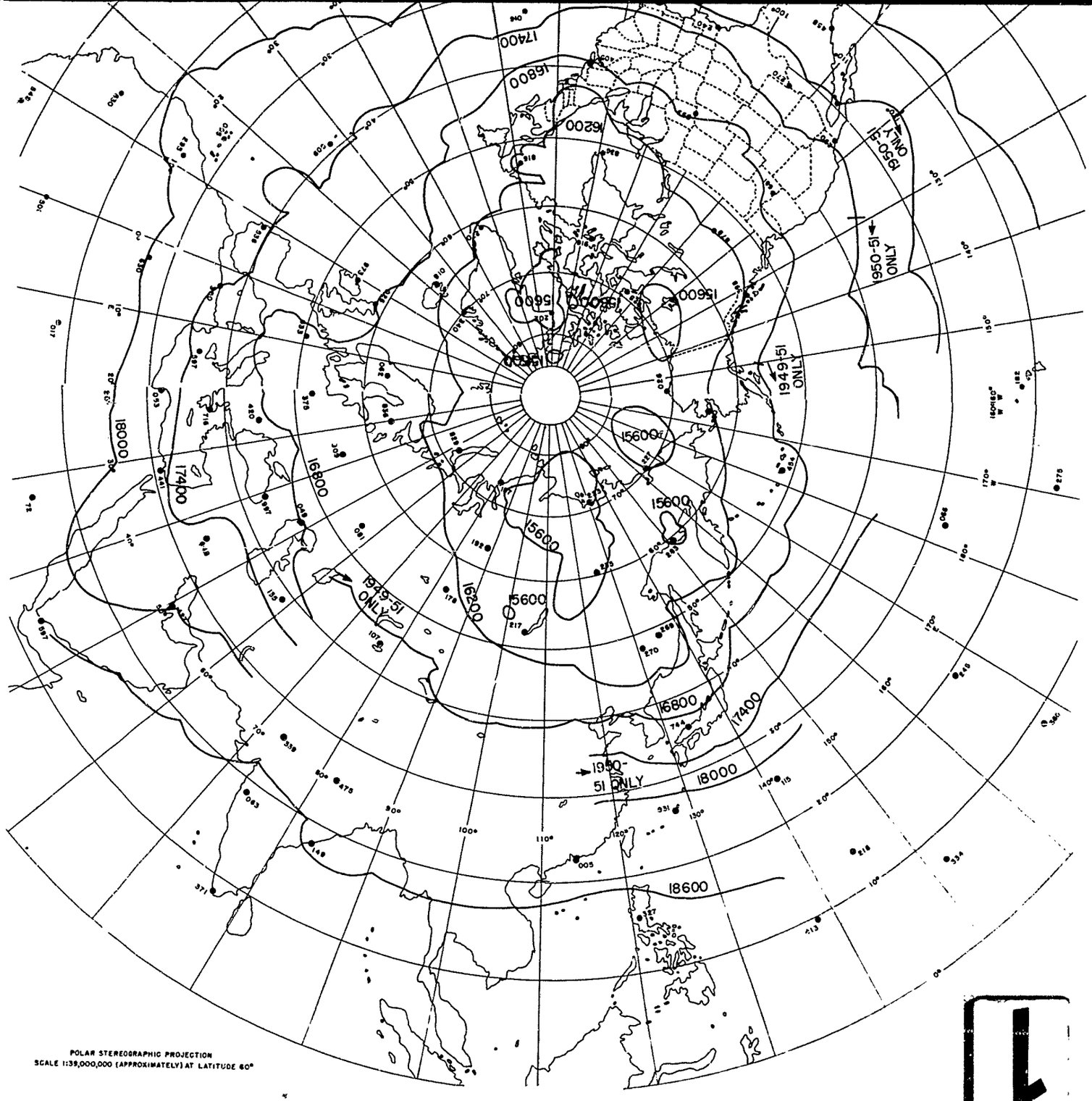
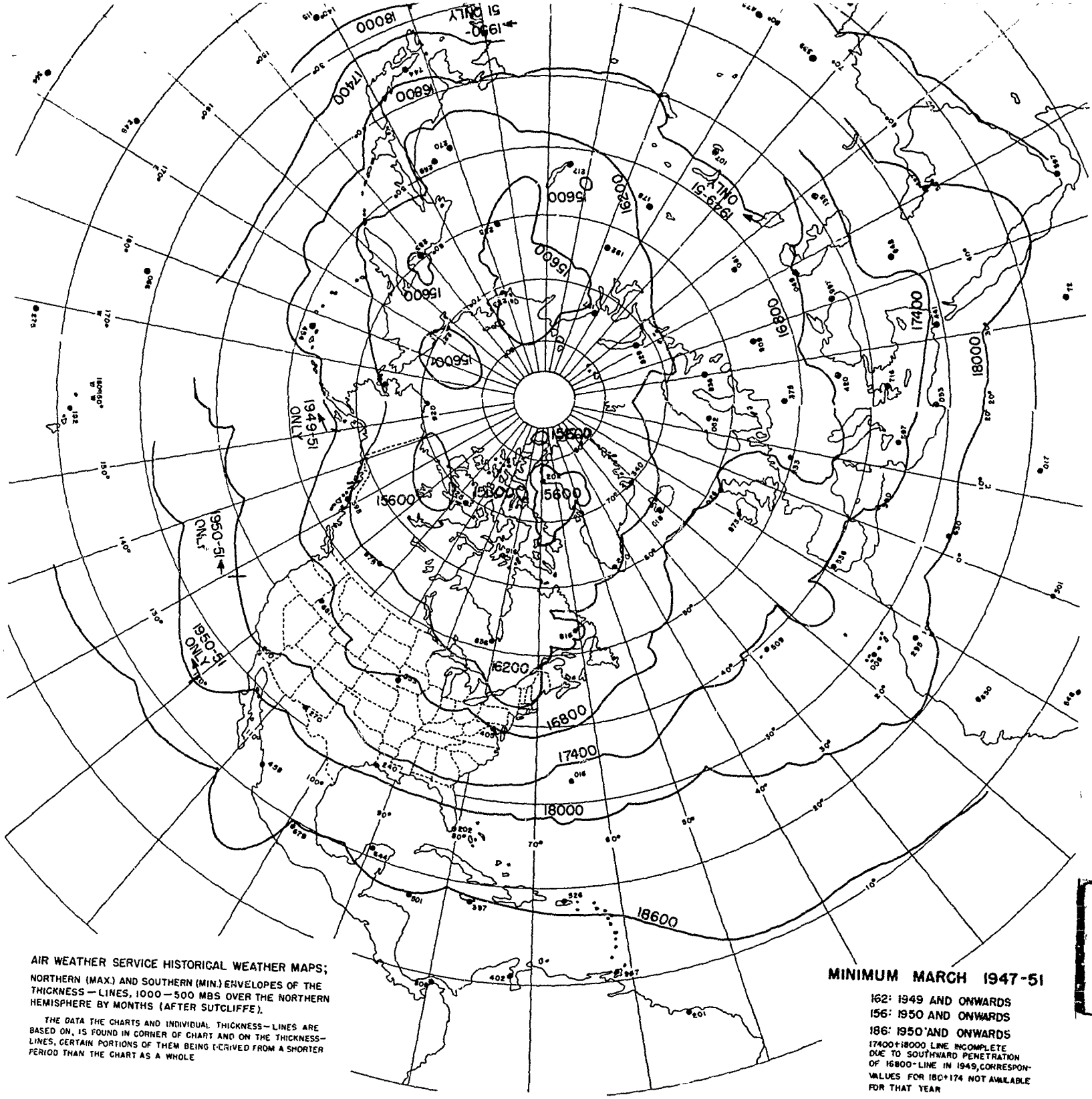
MAXIMUM FEBRUARY 1947-51



POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°

7



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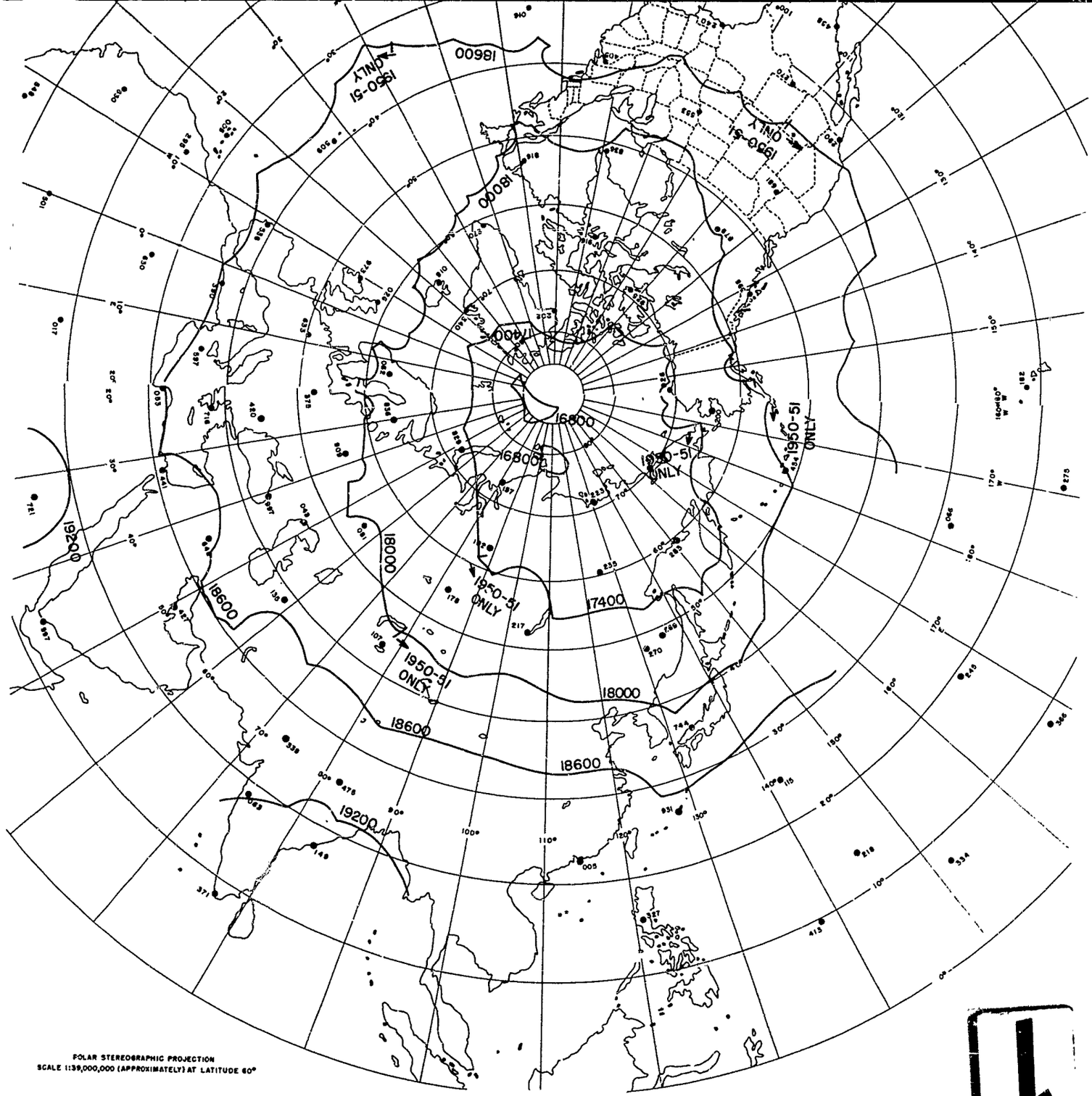
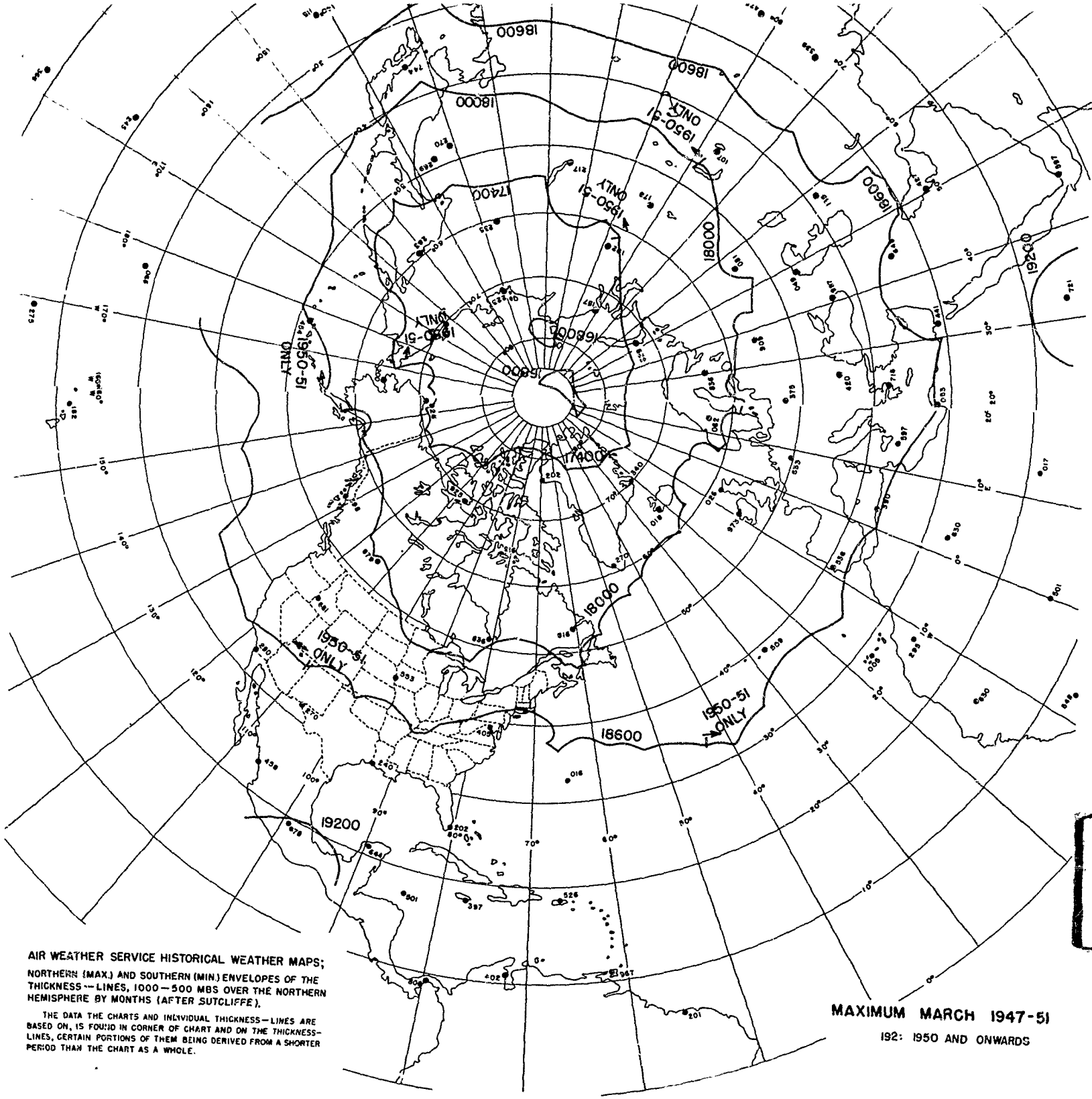
MINIMUM MARCH 1947-51

162: 1949 AND ONWARDS
156: 1950 AND ONWARDS
186: 1950 AND ONWARDS

17400+18000 LINE INCOMPLETE DUE TO SOUTHWARD PENETRATION OF 16800-LINE IN 1949, CORRESPONDING VALUES FOR 180+174 NOT AVAILABLE FOR THAT YEAR

2


18600
1950-51 ONLY
18000
16800
17400
19200
POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°



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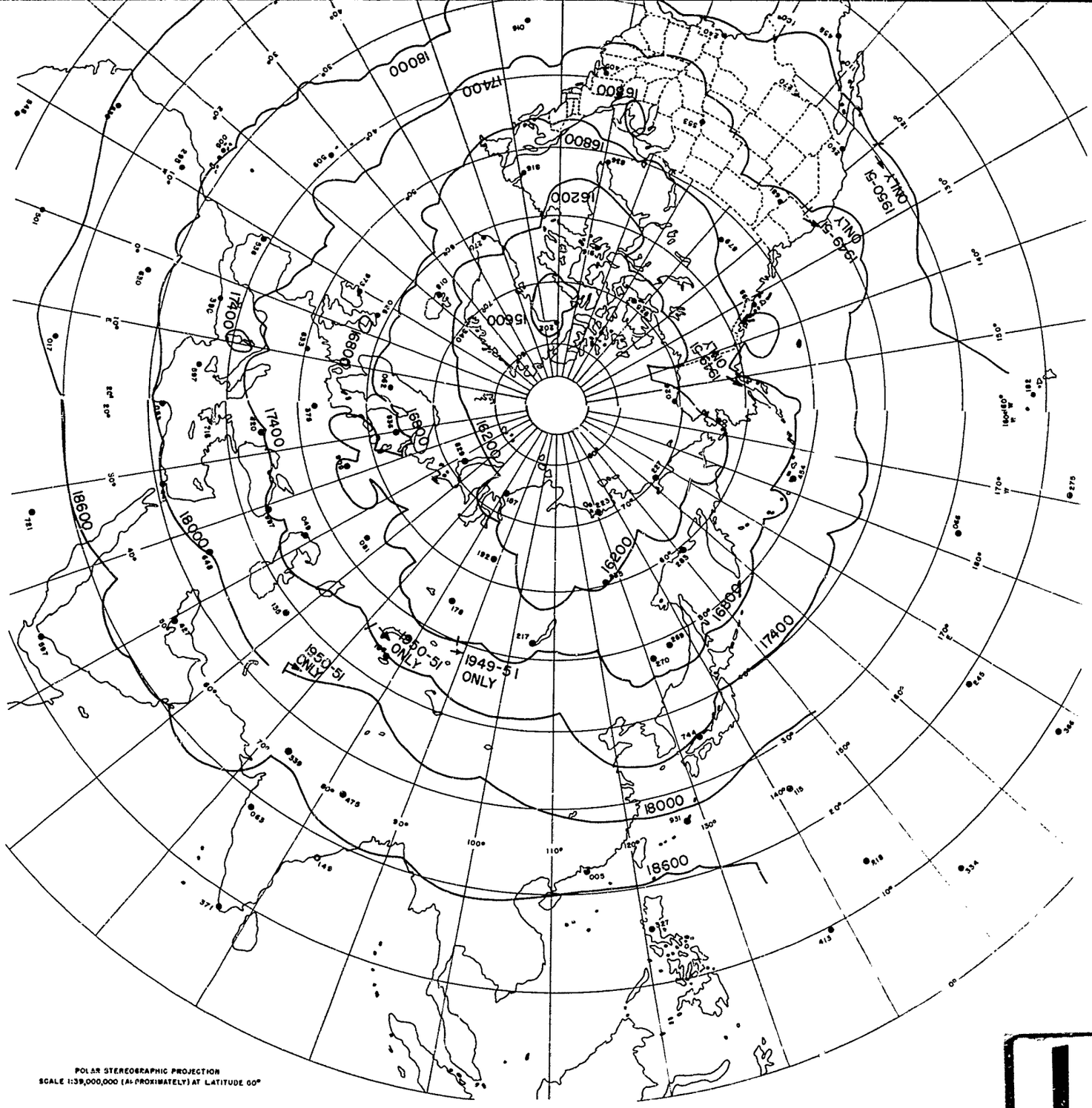
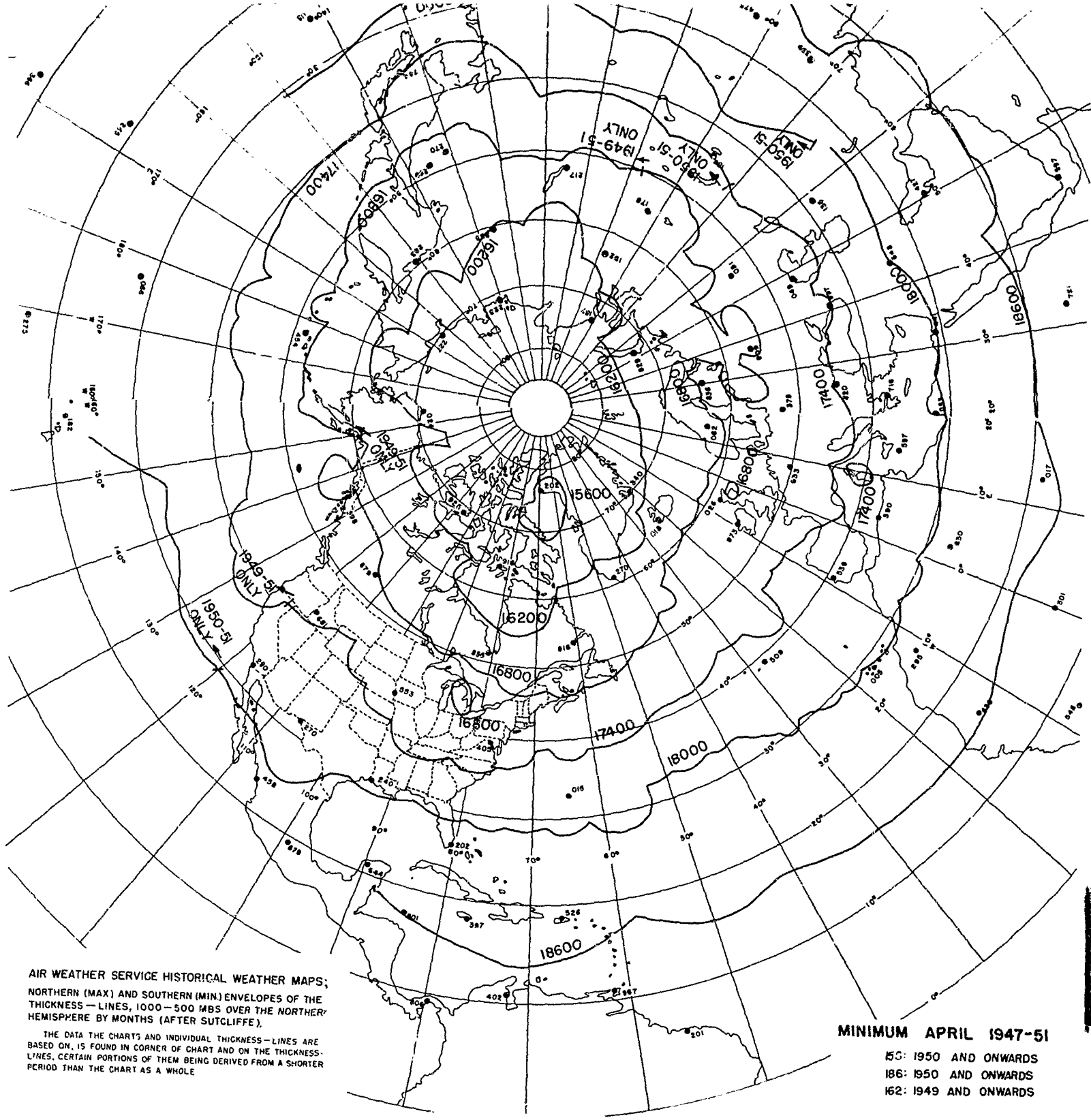
MAXIMUM MARCH 1947-51

192: 1950 AND ONWARDS

2



POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°



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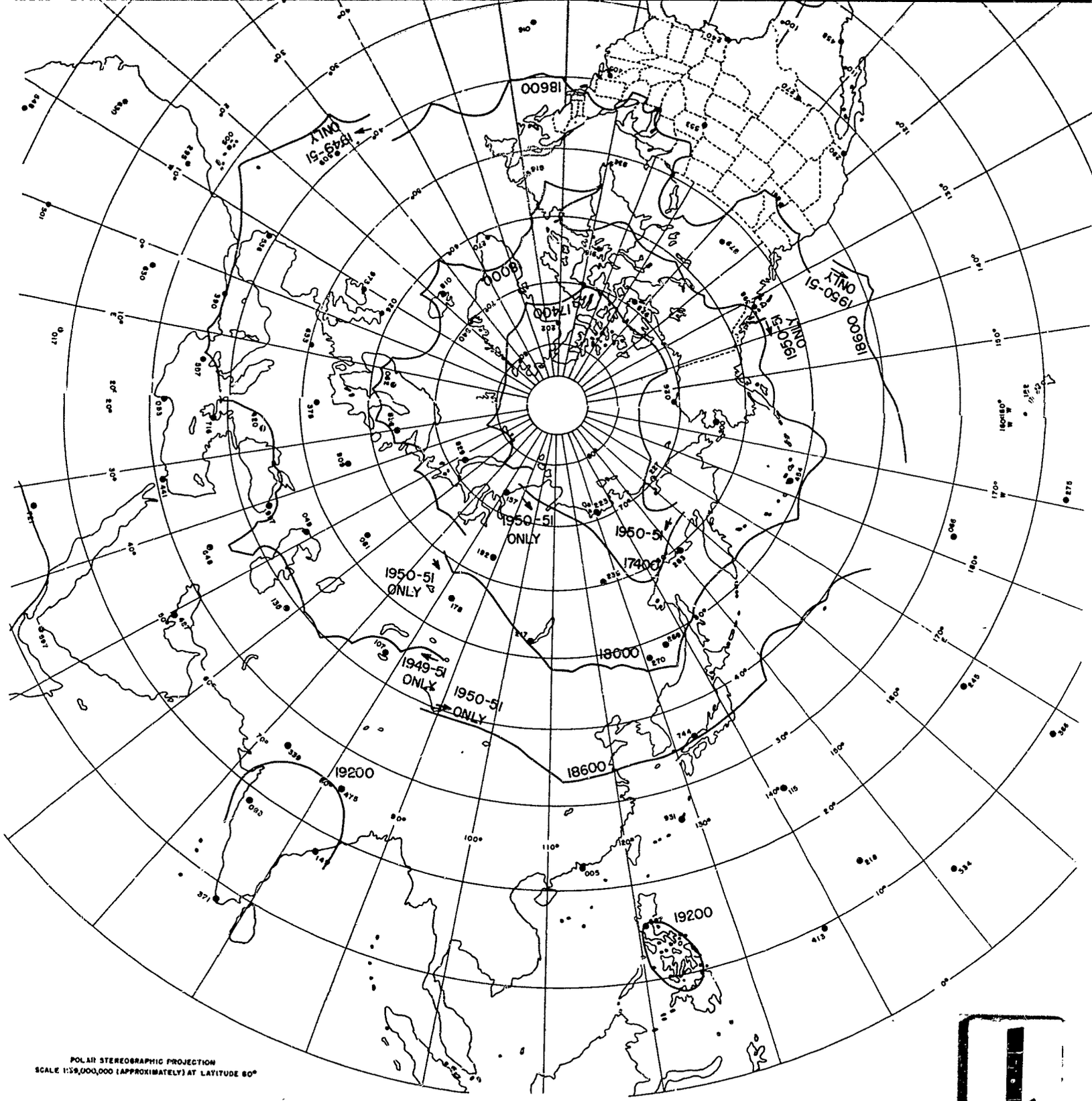
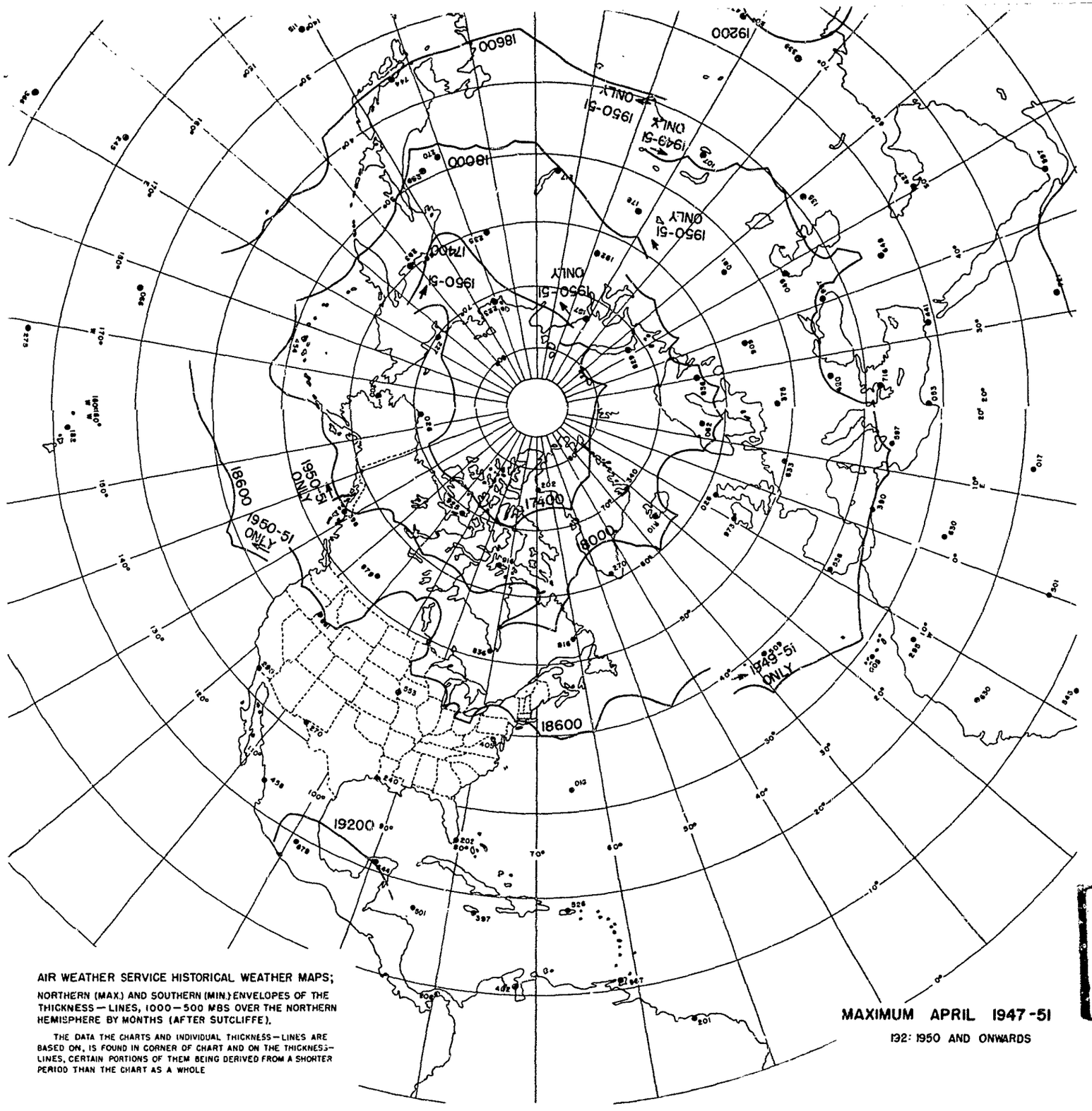
MINIMUM APRIL 1947-51

153: 1950 AND ONWARDS
186: 1950 AND ONWARDS
162: 1949 AND ONWARDS

2



POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°



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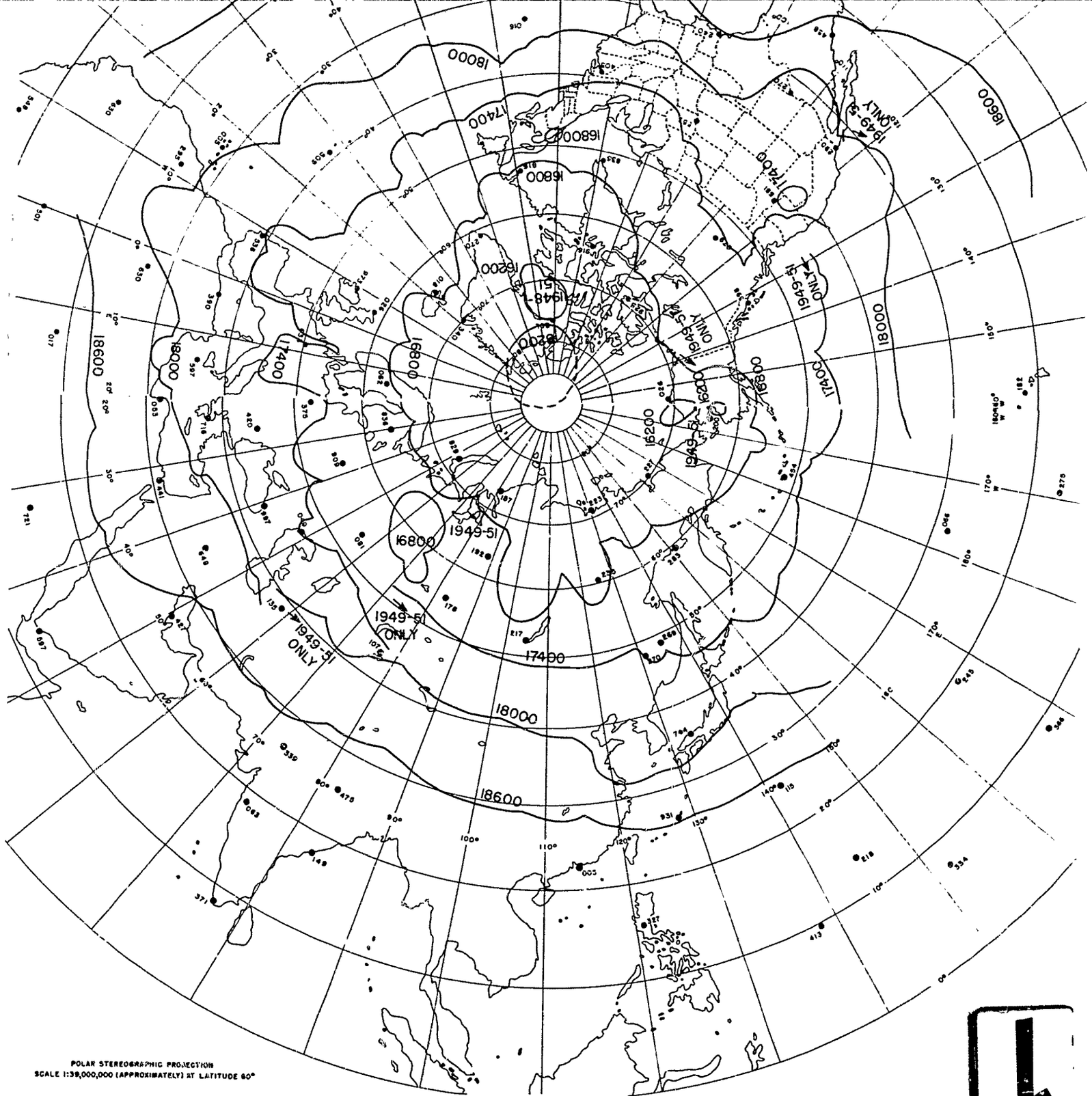
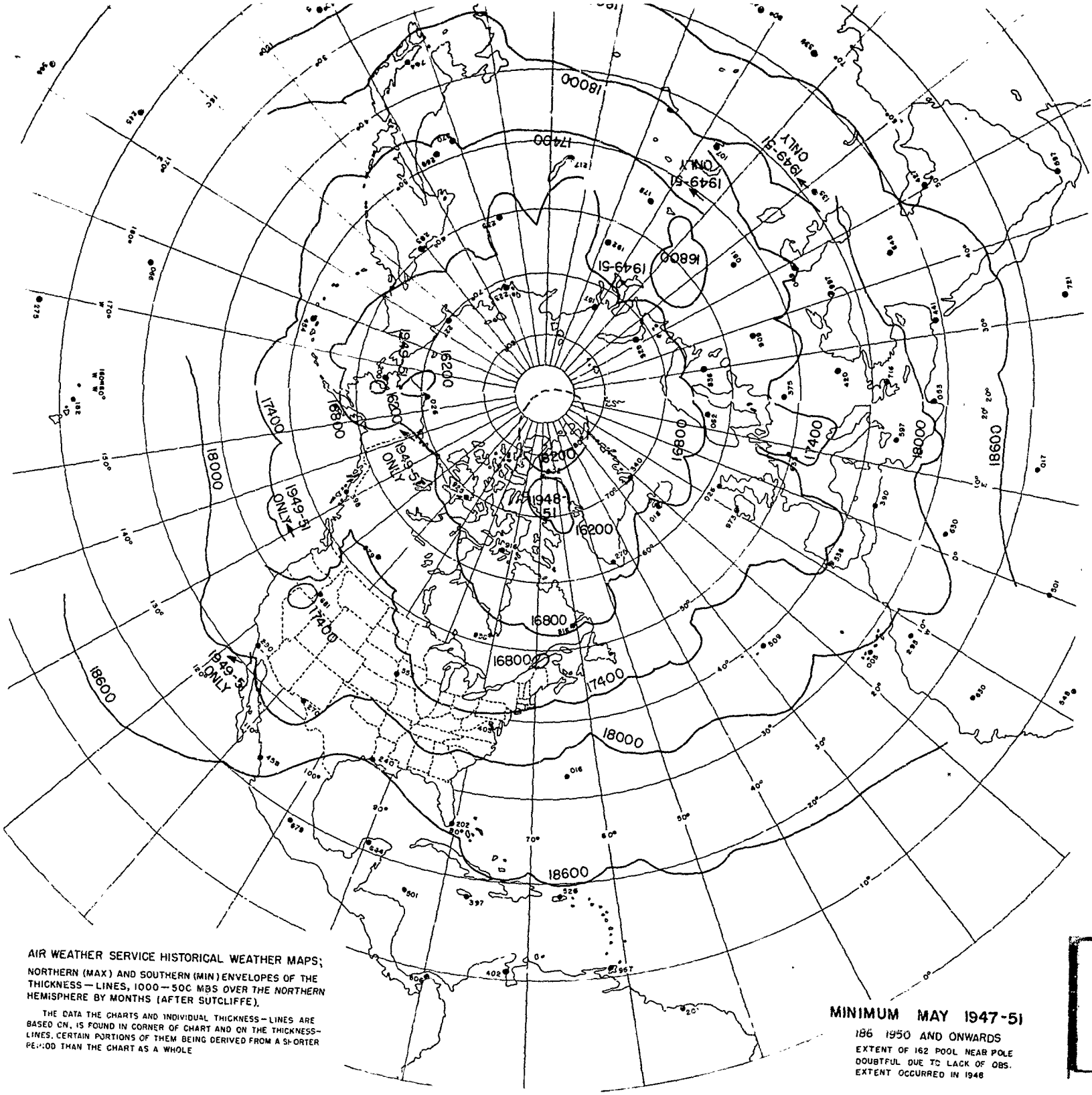
MAXIMUM APRIL 1947-51

1321 1950 AND ONWARDS

2


18000
17400
16800
16200
1949-51
1949-51 ONLY
18600
POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°



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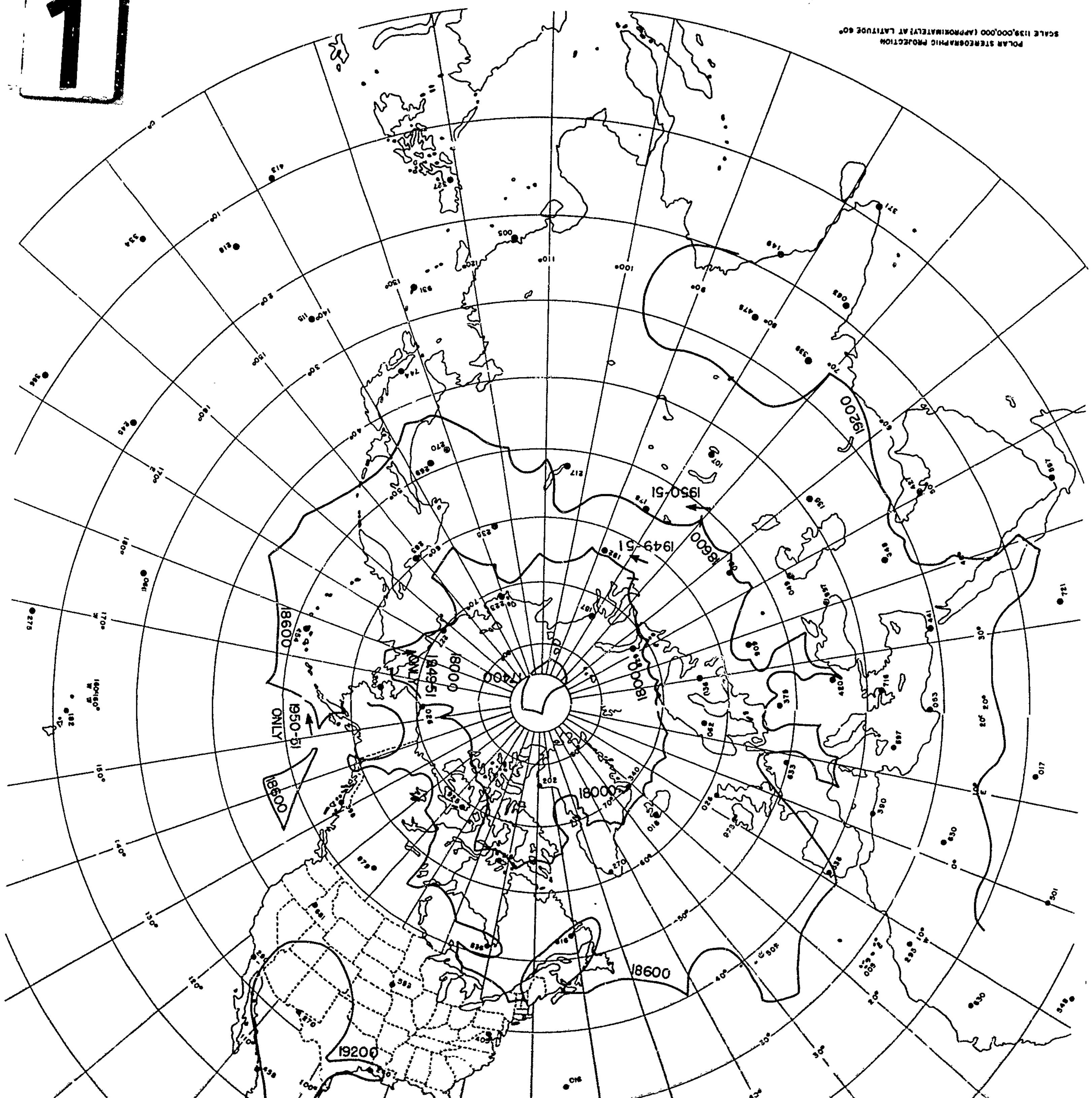
MINIMUM MAY 1947-51

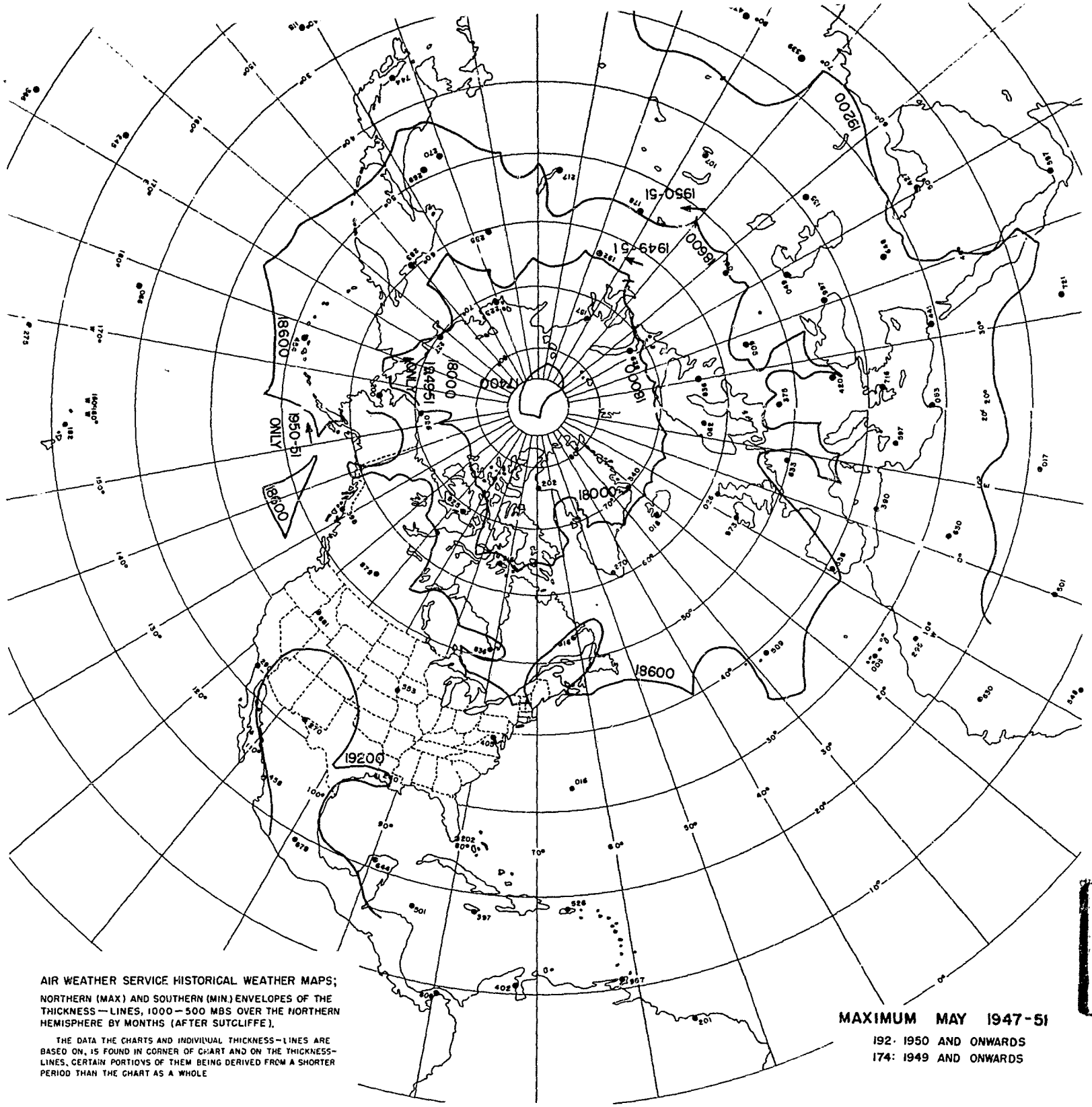
186 1950 AND ONWARDS

EXTENT OF 162 POOL NEAR POLE DOUBTFUL DUE TO LACK OF OBS. EXTENT OCCURRED IN 1948

2

1


POLAR STEREOGRAPHIC PROJECTION
SCALE 1:35,000,000 (APPROXIMATELY) AT LATITUDE 60°
19200
18600
18000
17400
1950-51
1949-51
1950-51 ONLY
1949-51 ONLY



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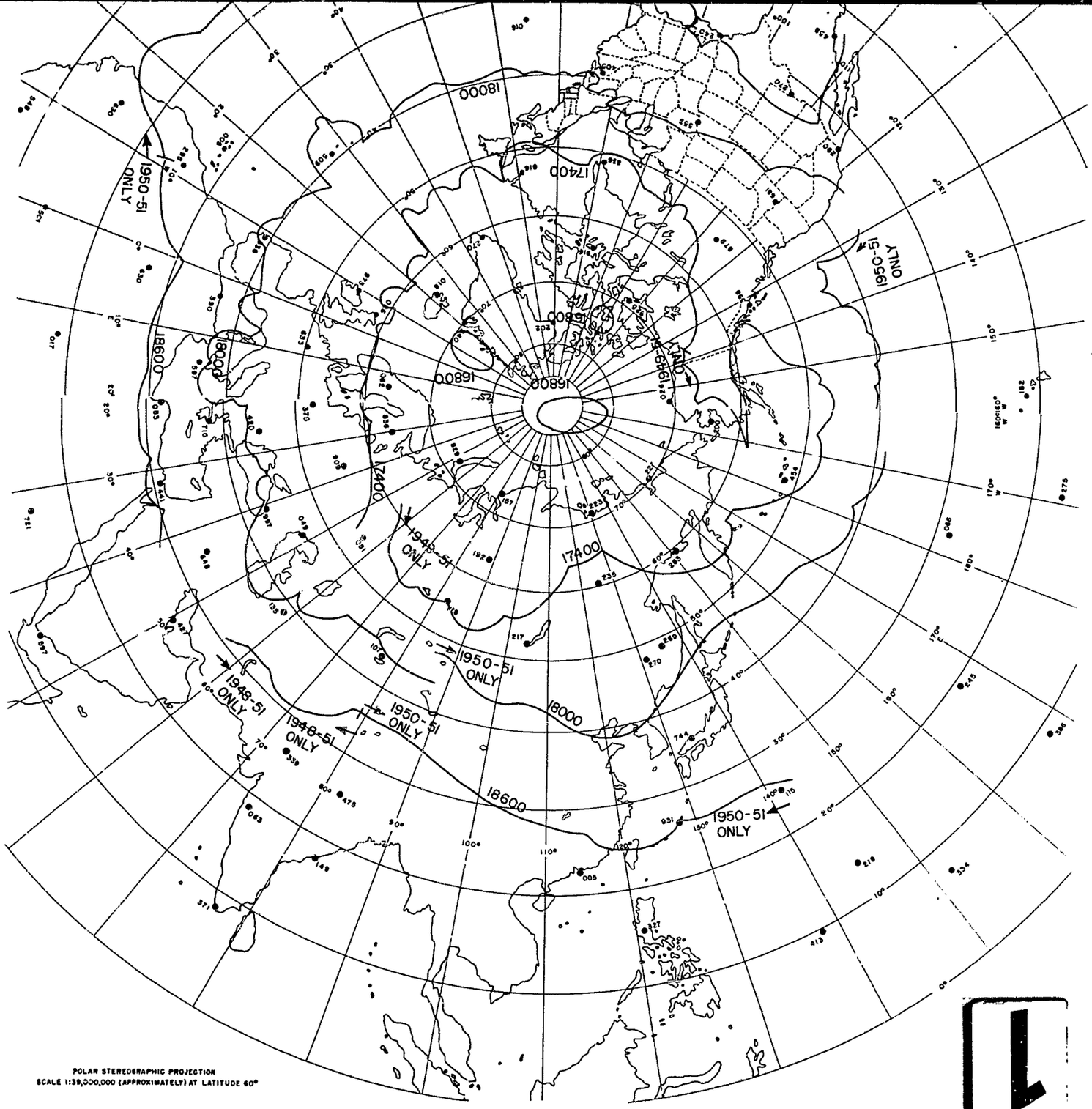
MAXIMUM MAY 1947-51

192: 1950 AND ONWARDS

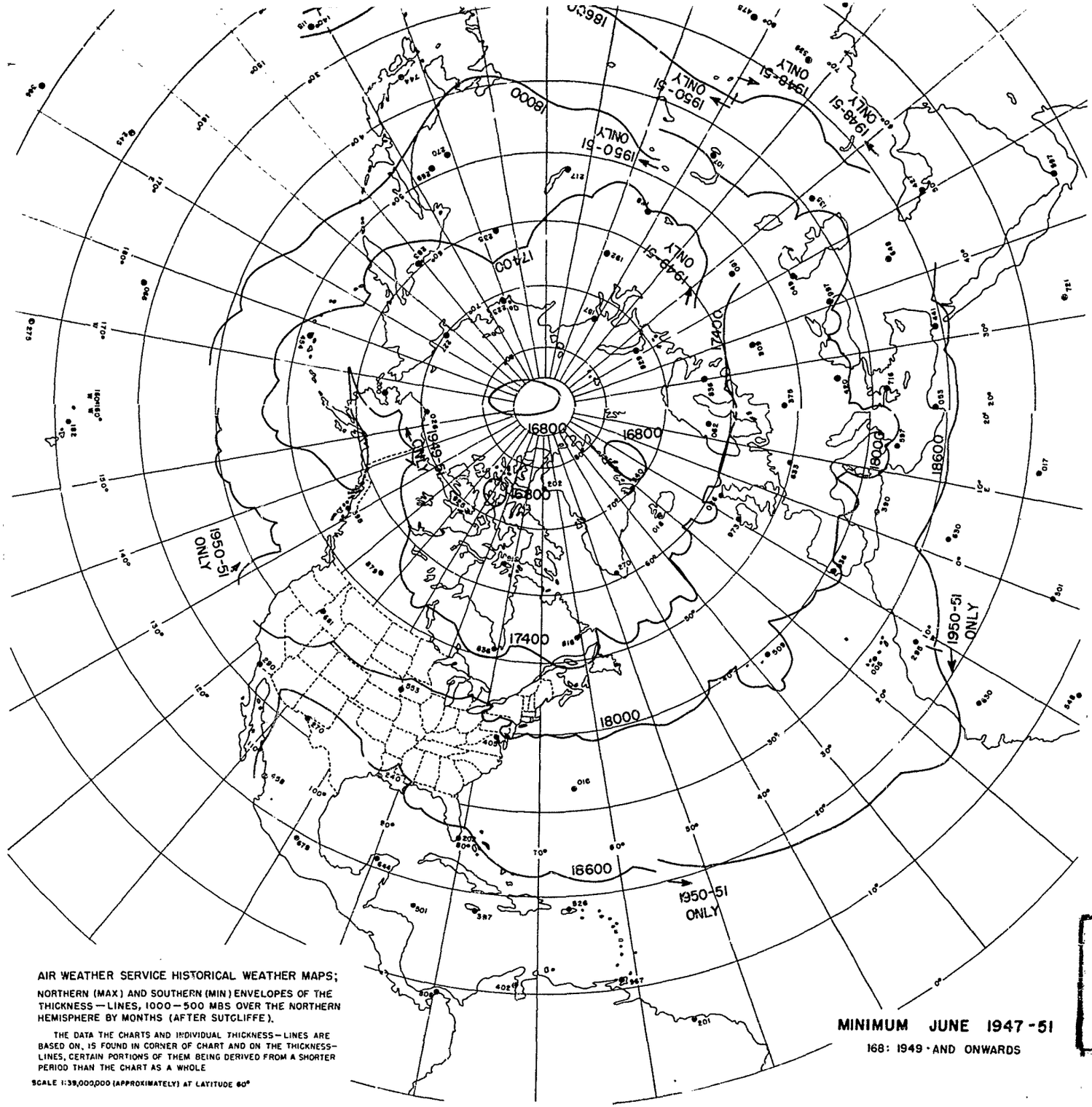
174: 1949 AND ONWARDS

2



POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°

7



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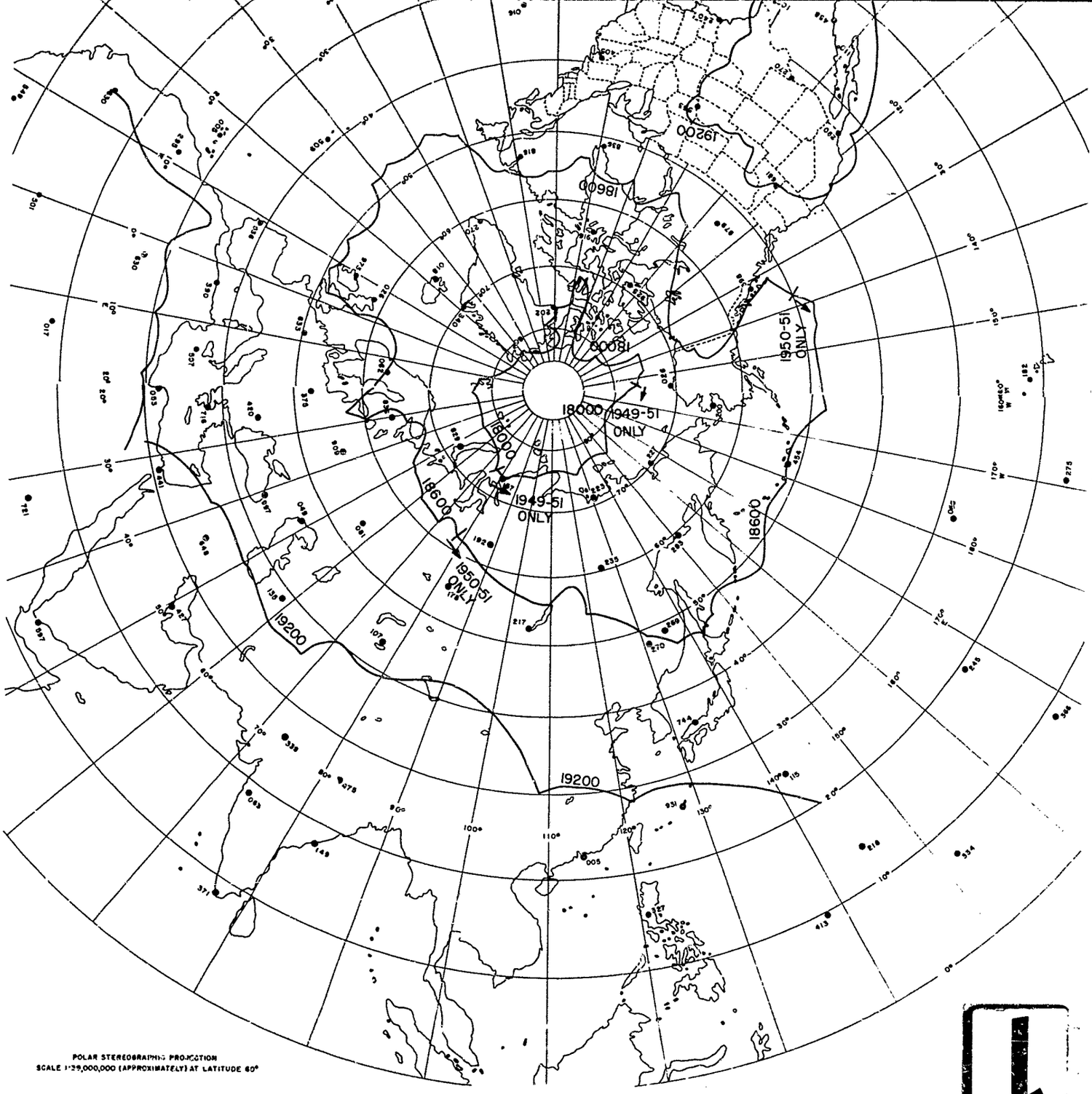
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°

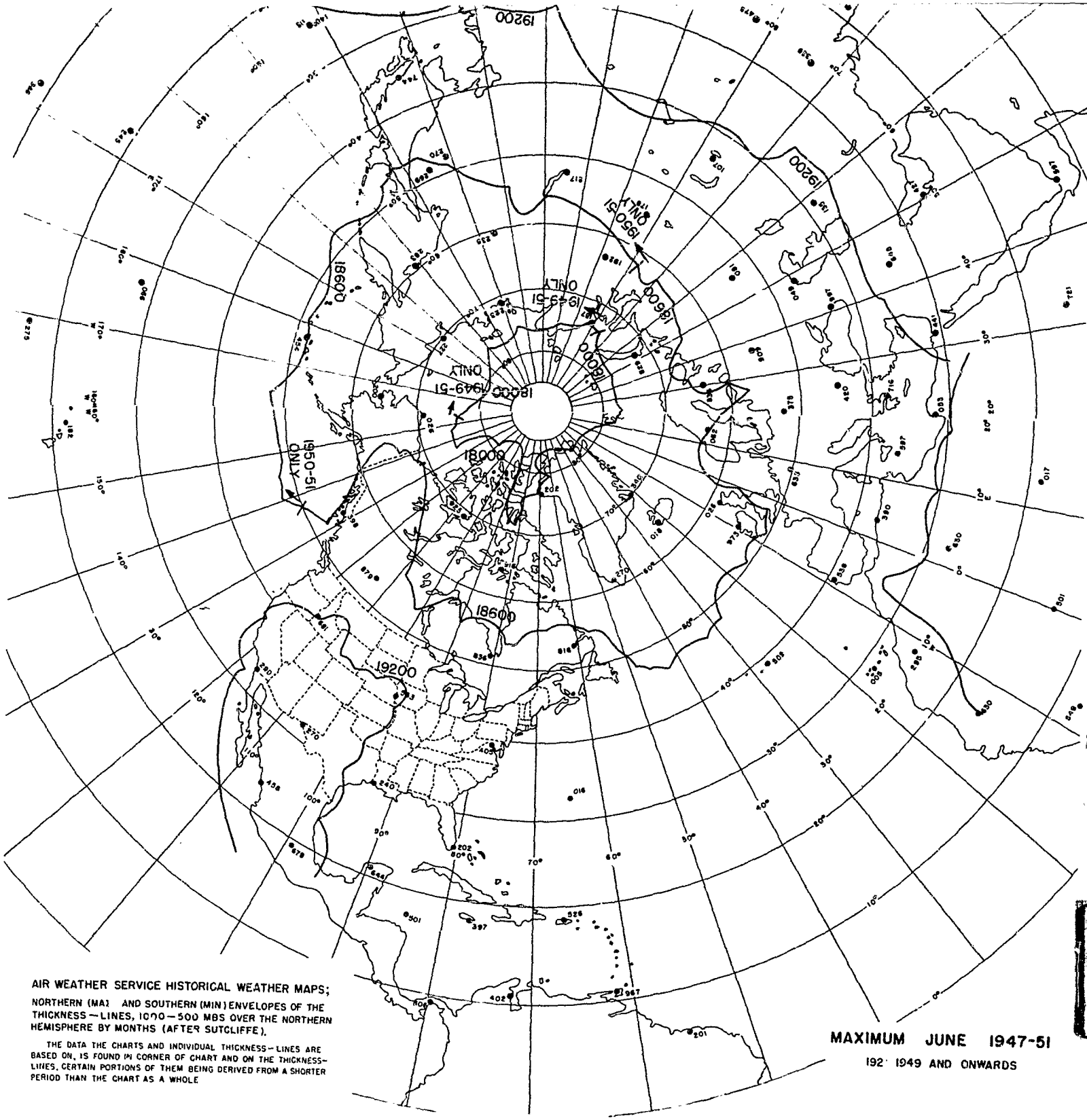
MINIMUM JUNE 1947-51

168: 1949 - AND ONWARDS

2



POLAR STEREOGRAPHIC PROJECTION
SCALE 1:29,000,000 (APPROXIMATELY) AT LATITUDE 60°



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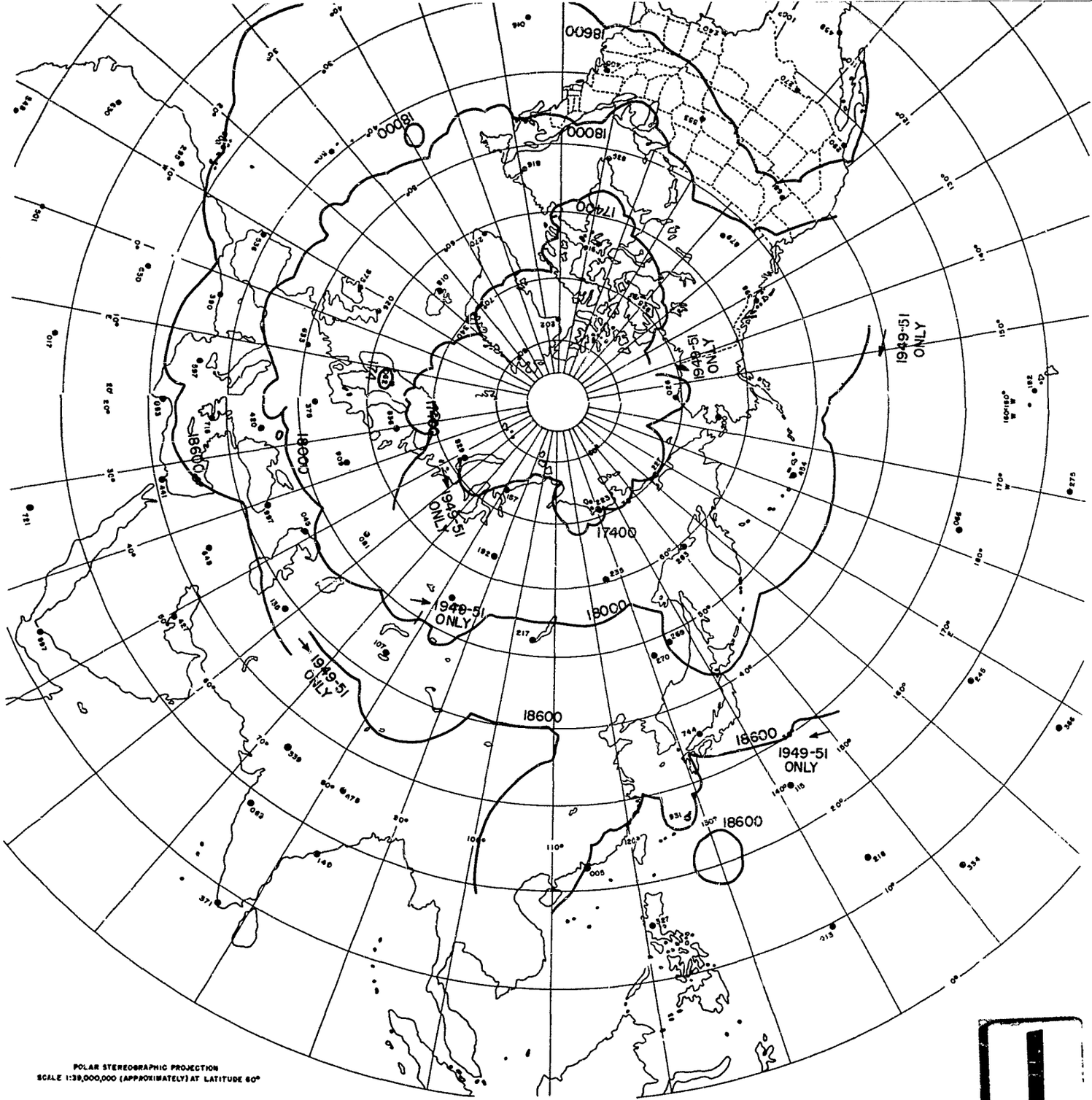
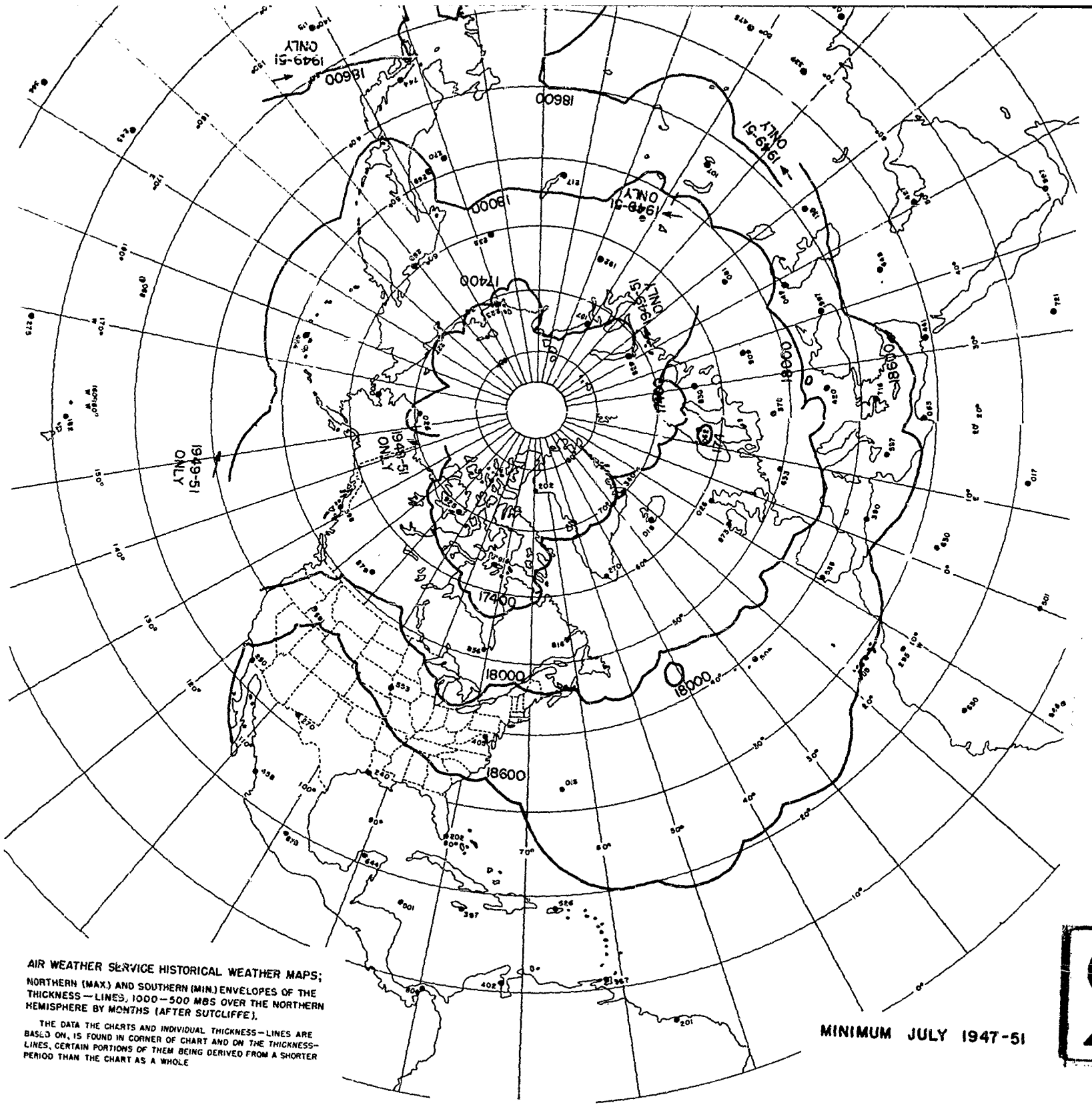
MAXIMUM JUNE 1947-51

192 1949 AND ONWARDS

2



POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°



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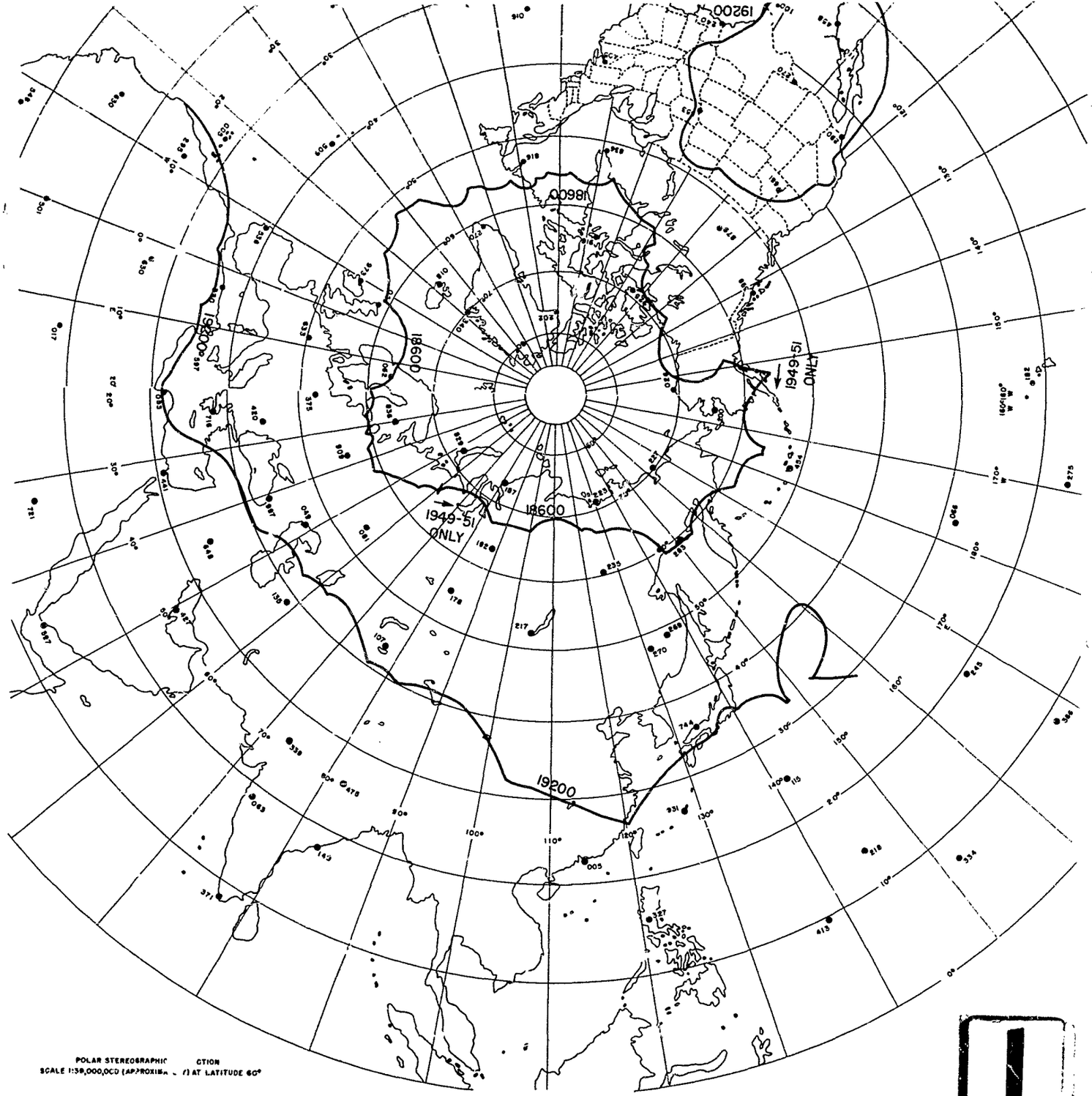
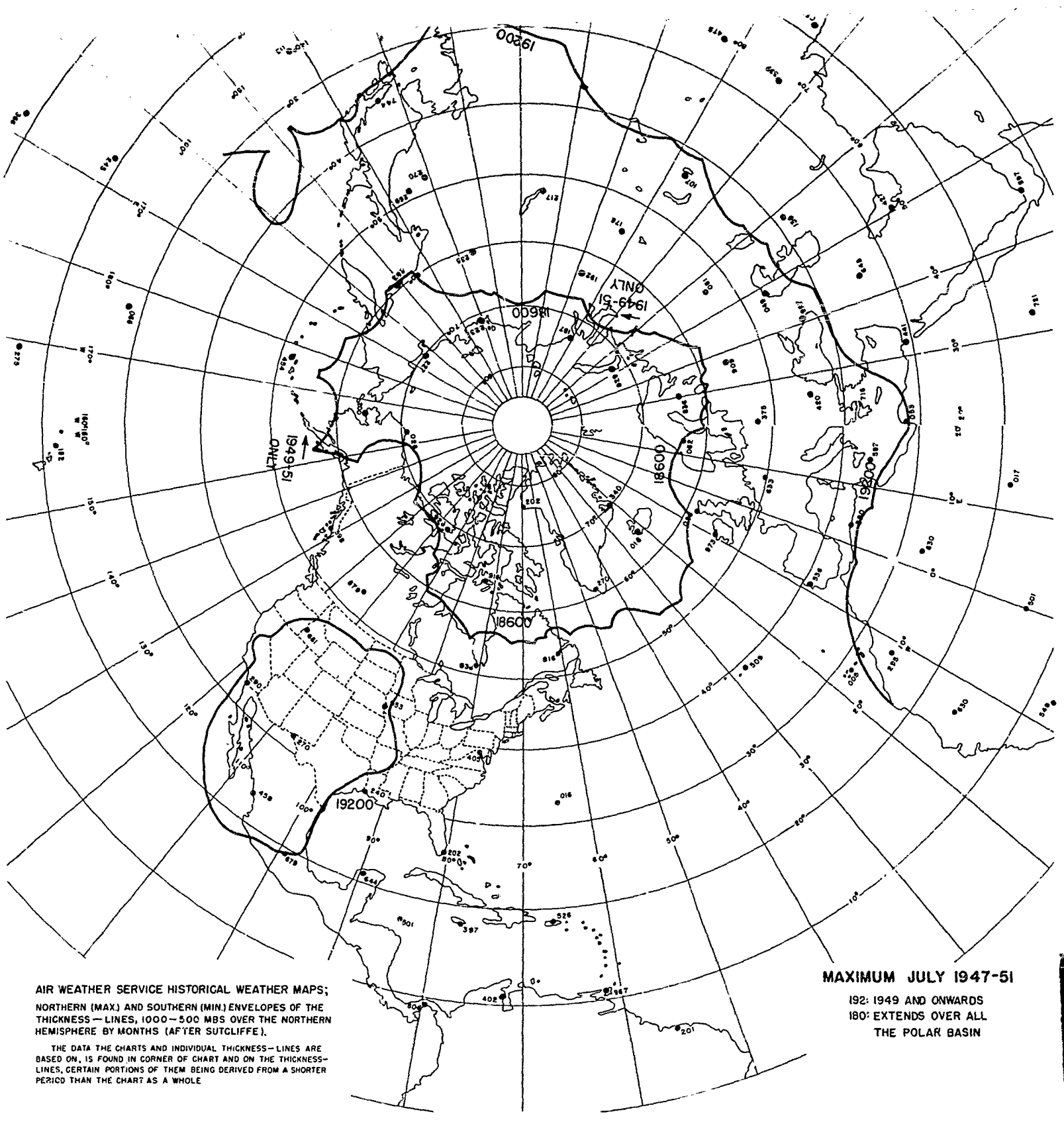
MINIMUM JULY 1947-51

2



POLAR STEREOGRAPHIC CTION
SCALE 1:38,000,000 (APPROXIM) AT LATITUDE 60°

1



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THE DATA THE CHARTS AND INDIVIDUAL THICKNESS — LINES ARE BASED ON, IS FOUND IN CORNER OF CHART AND ON THE THICKNESS-LINES, CERTAIN PORTIONS OF THEM BEING DERIVED FROM A SHORTER PERIOD THAN THE CHART AS A WHOLE

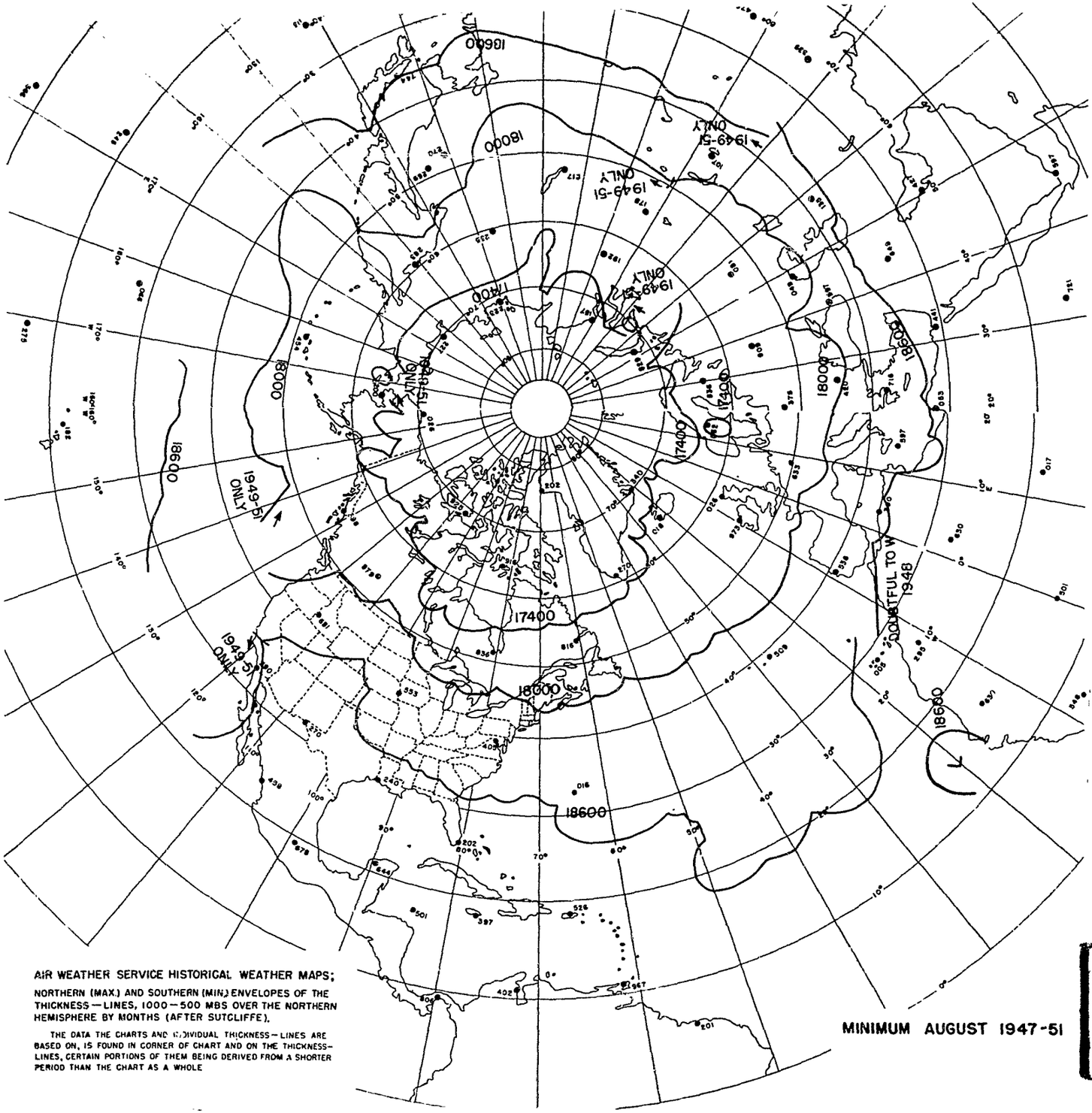
MAXIMUM JULY 1947-51

192: 1949 AND ONWARDS
180: EXTENDS OVER ALL THE POLAR BASIN

2

1

POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°
18600
18000
1949-51 ONLY
17400
DOUBTFUL TO W
1948



AIR WEATHER SERVICE HISTORICAL WEATHER MAPS;

NORTHERN (MAX.) AND SOUTHERN (MIN.) ENVELOPES OF THE THICKNESS—LINES, 1000—500 MBS OVER THE NORTHERN HEMISPHERE BY MONTHS (AFTER SUTCLIFFE).

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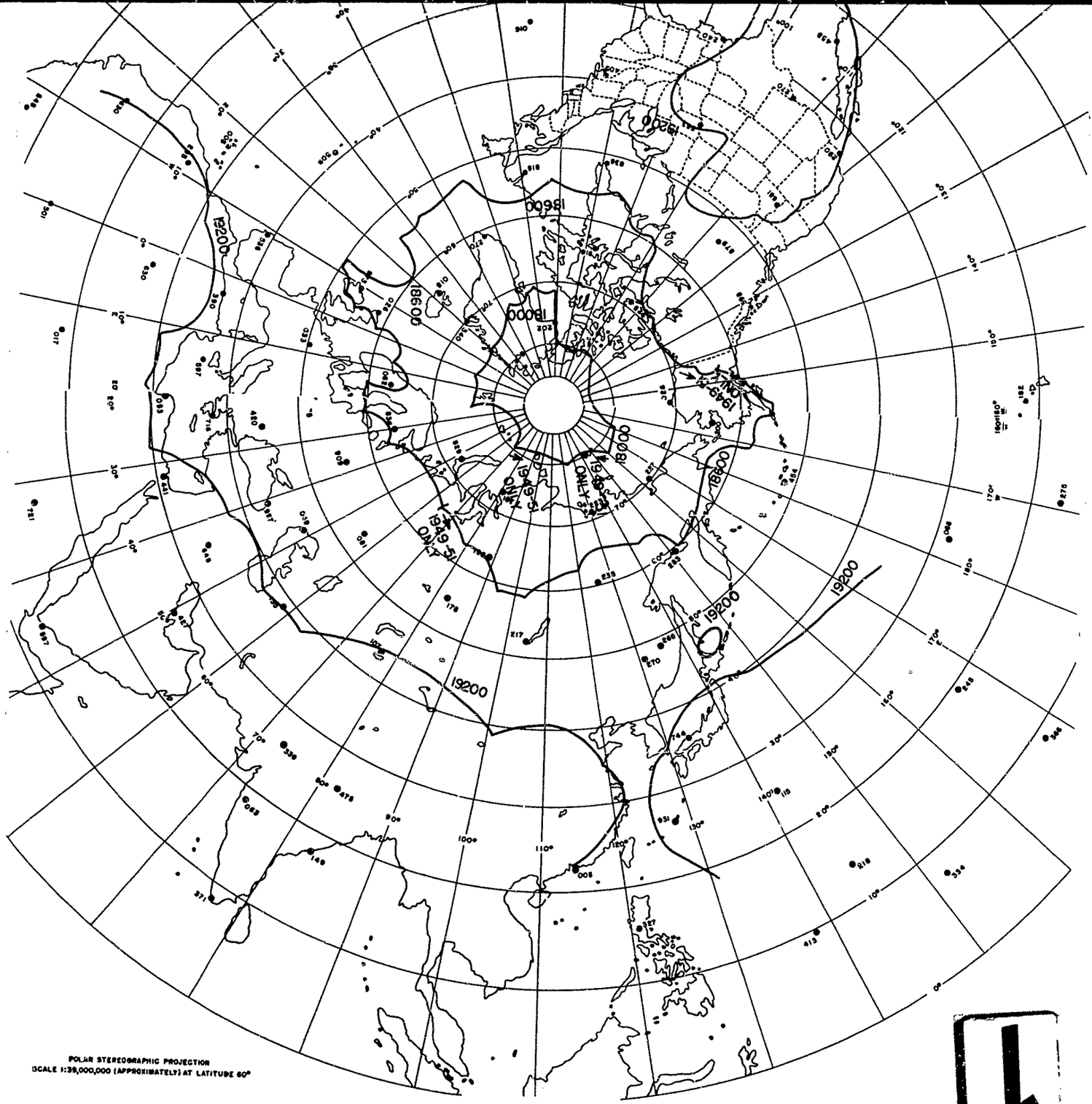
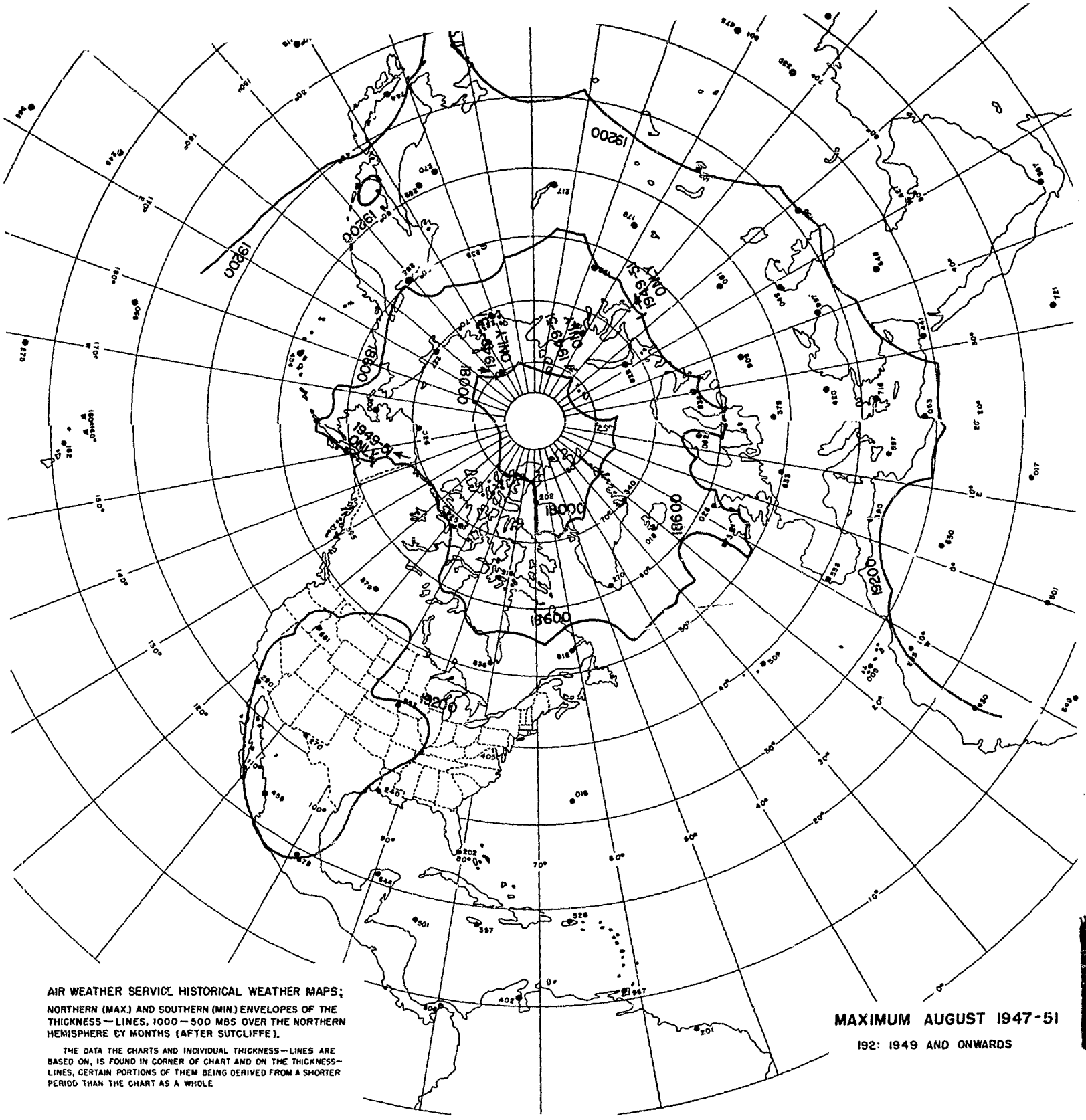
MINIMUM AUGUST 1947-51

2


18600
19200
1949 ONLY
1949-51 ONLY
1949-52 ONLY
1949-53 ONLY
POLAR STEREOGRAPHIC PROJECTION
SCALE 1:38,000,000 (APPROXIMATELY) AT LATITUDE 60°

7



AIR WEATHER SERVICE HISTORICAL WEATHER MAPS;

NORTHERN (MAX.) AND SOUTHERN (MIN.) ENVELOPES OF THE THICKNESS — LINES, 1000 — 500 MBS OVER THE NORTHERN HEMISPHERE BY MONTHS (AFTER SUTCLIFFE).

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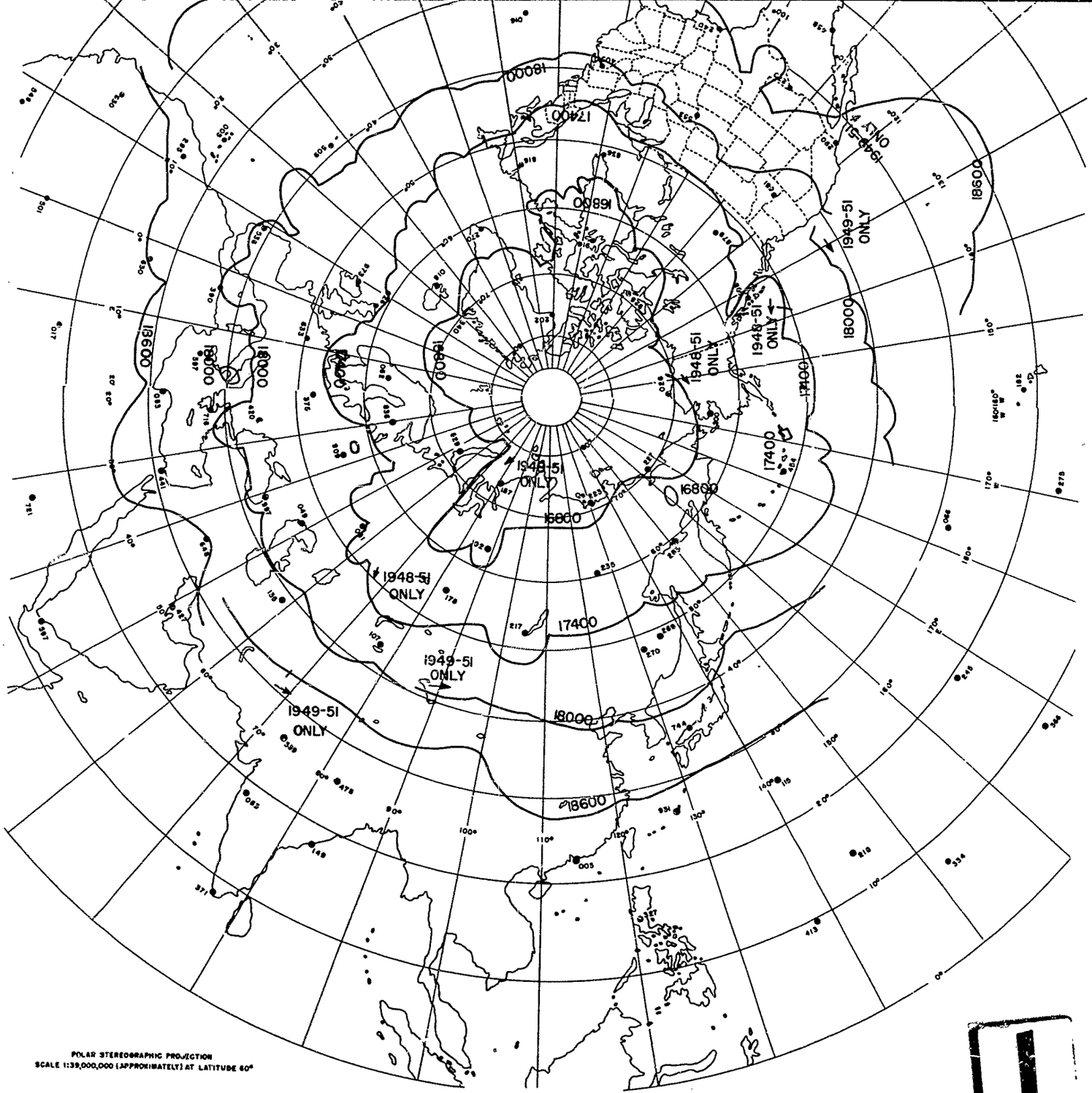
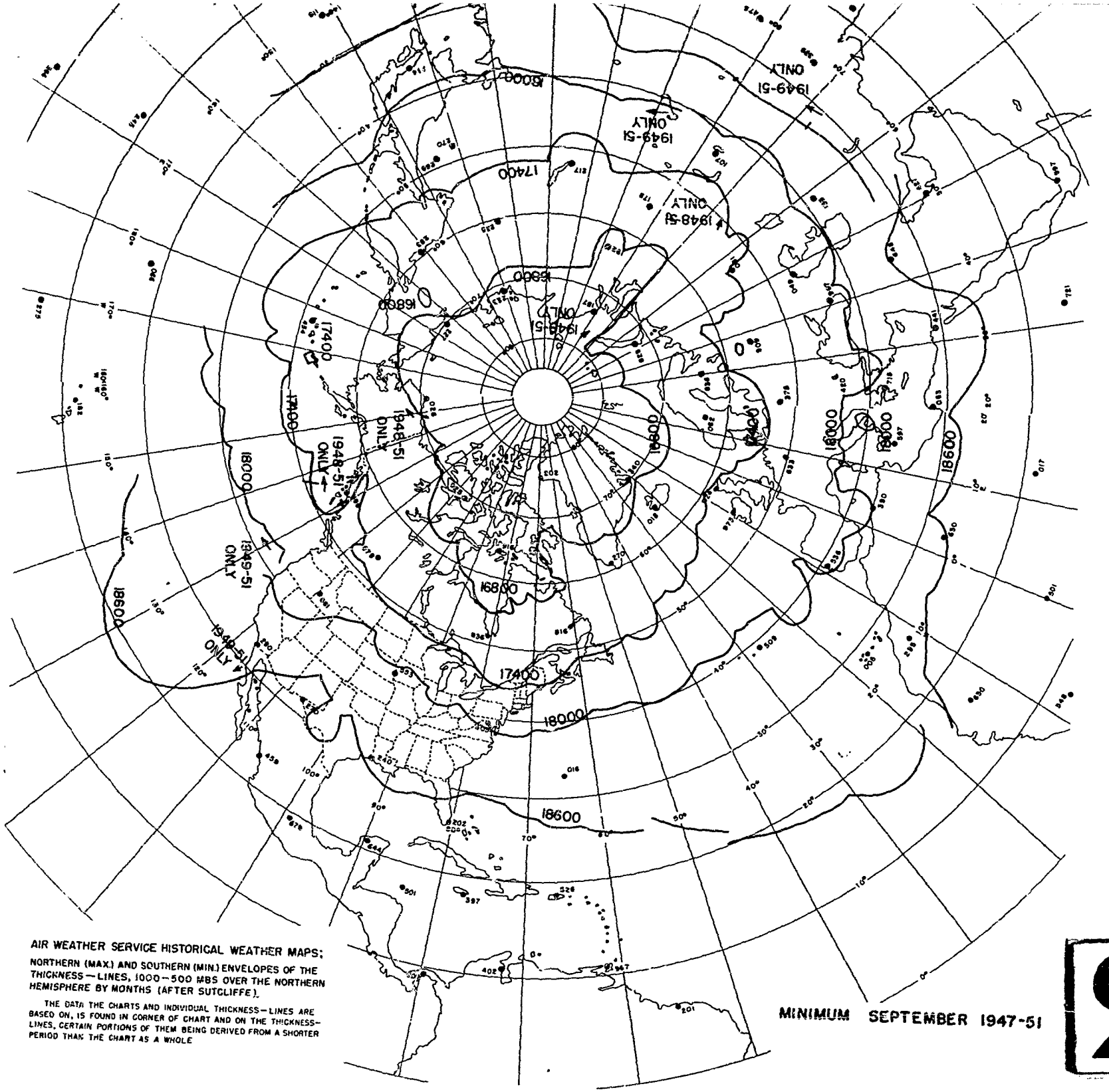
MAXIMUM AUGUST 1947-51

192: 1949 AND ONWARDS

2


18000
17400
1948-51 ONLY
1949-51 ONLY
16800
18600
POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°



AIR WEATHER SERVICE HISTORICAL WEATHER MAPS:

NORTHERN (MAX.) AND SOUTHERN (MIN.) ENVELOPES OF THE THICKNESS—LINES, 1000–500 MBS OVER THE NORTHERN HEMISPHERE BY MONTHS (AFTER SUTCLIFFE).

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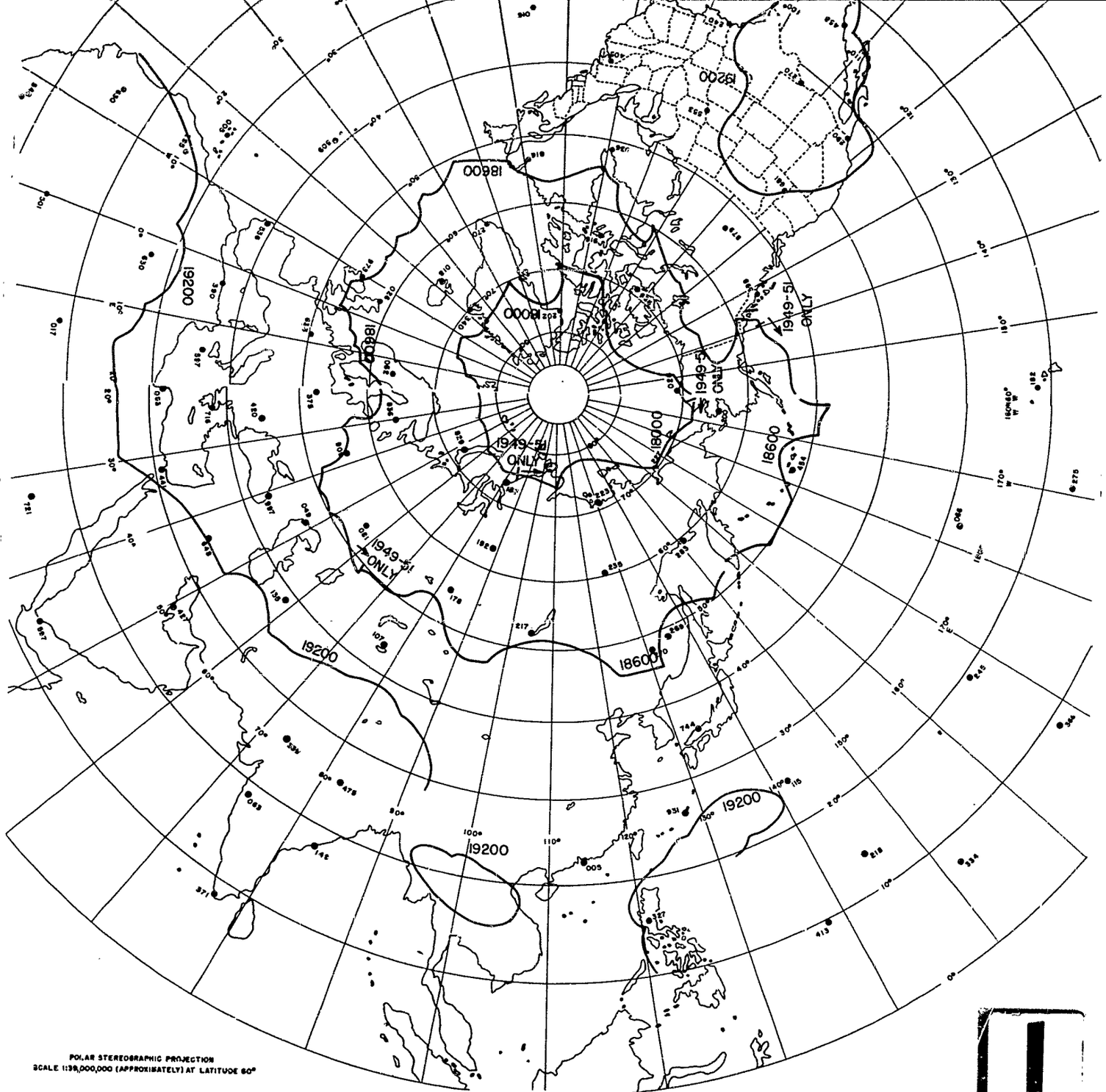
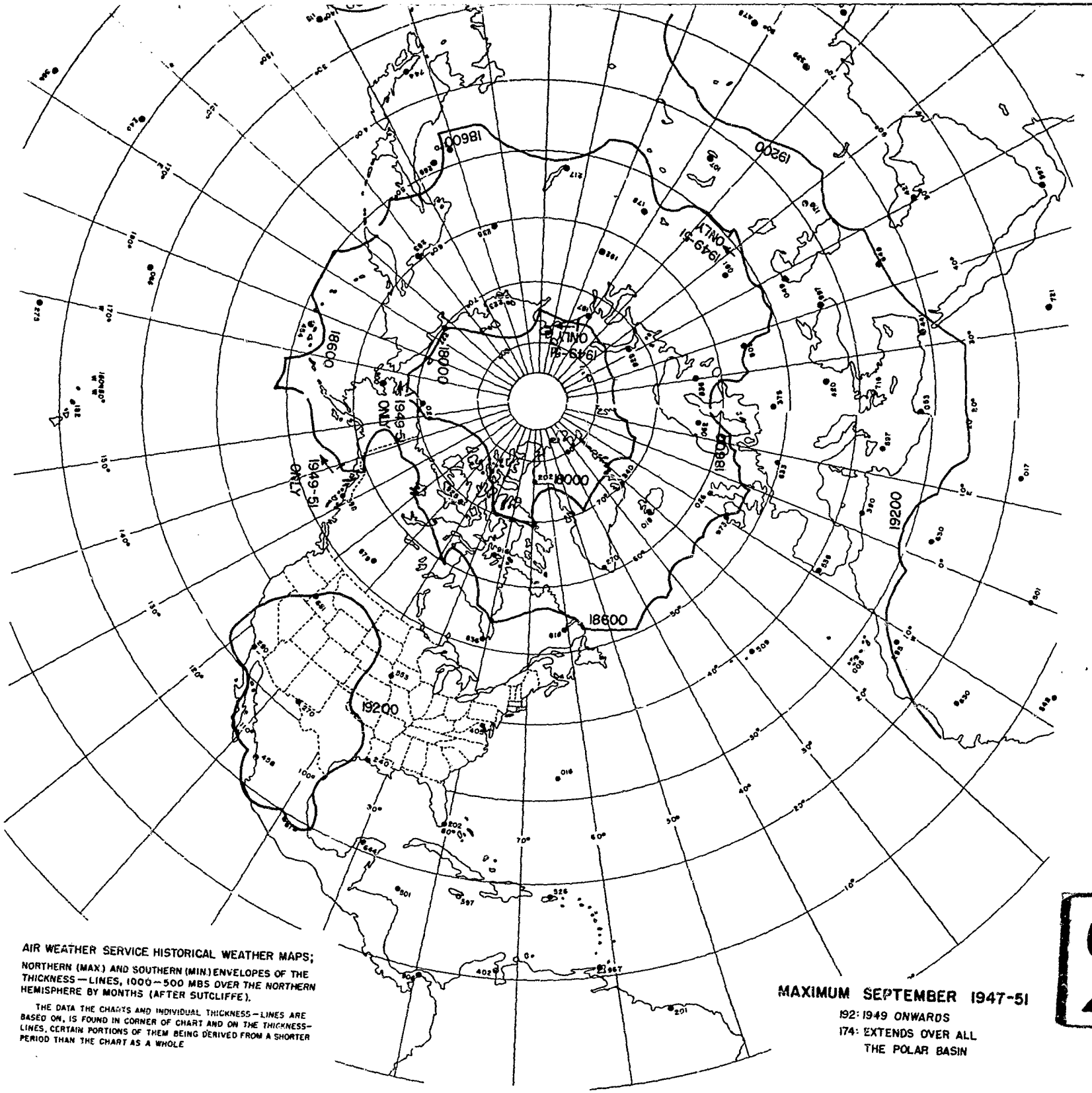
MINIMUM SEPTEMBER 1947-51

2


19200
18600
1949-51 ONLY
POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°



AIR WEATHER SERVICE HISTORICAL WEATHER MAPS;

NORTHERN (MAX.) AND SOUTHERN (MIN.) ENVELOPES OF THE THICKNESS — LINES, 1000 — 500 MBS OVER THE NORTHERN HEMISPHERE BY MONTHS (AFTER SUTCLIFFE).

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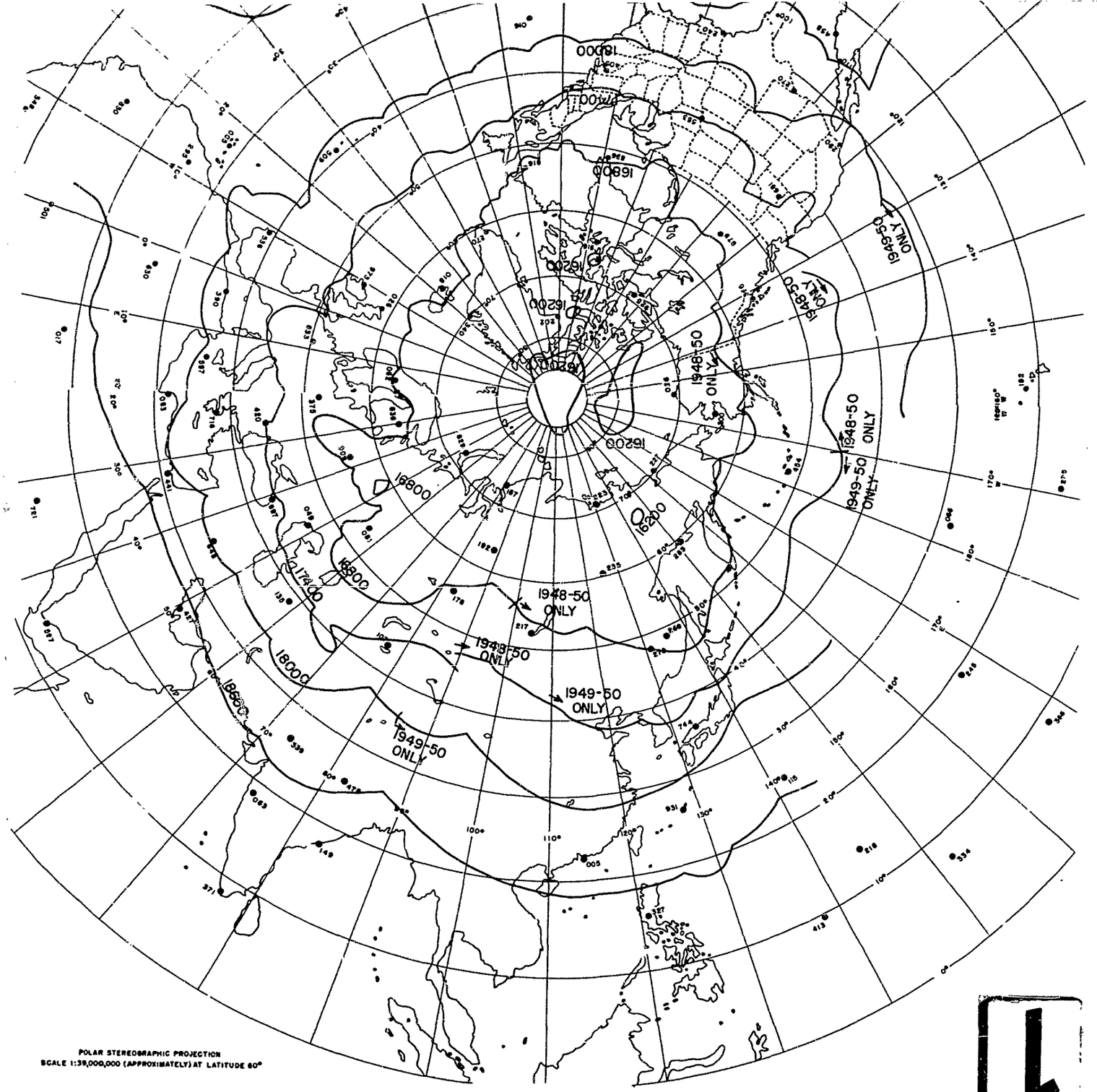
MAXIMUM SEPTEMBER 1947-51

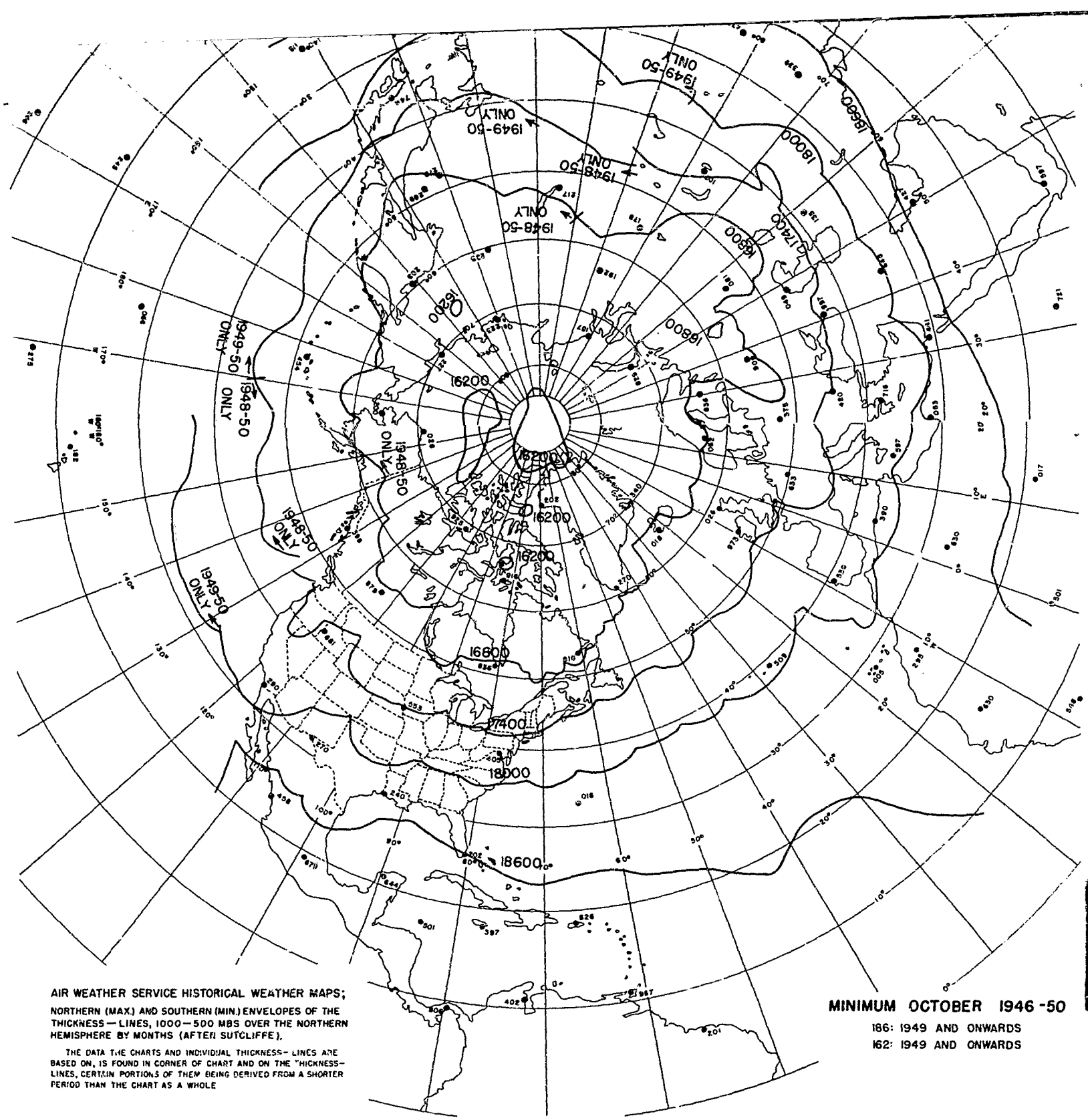
192: 1949 ONWARDS

174: EXTENDS OVER ALL THE POLAR BASIN

2



POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°



AIR WEATHER SERVICE HISTORICAL WEATHER MAPS;

NORTHERN (MAX.) AND SOUTHERN (MIN.) ENVELOPES OF THE THICKNESS — LINES, 1000 — 500 MBS OVER THE NORTHERN HEMISPHERE BY MONTHS (AFTER SUTCLIFFE).

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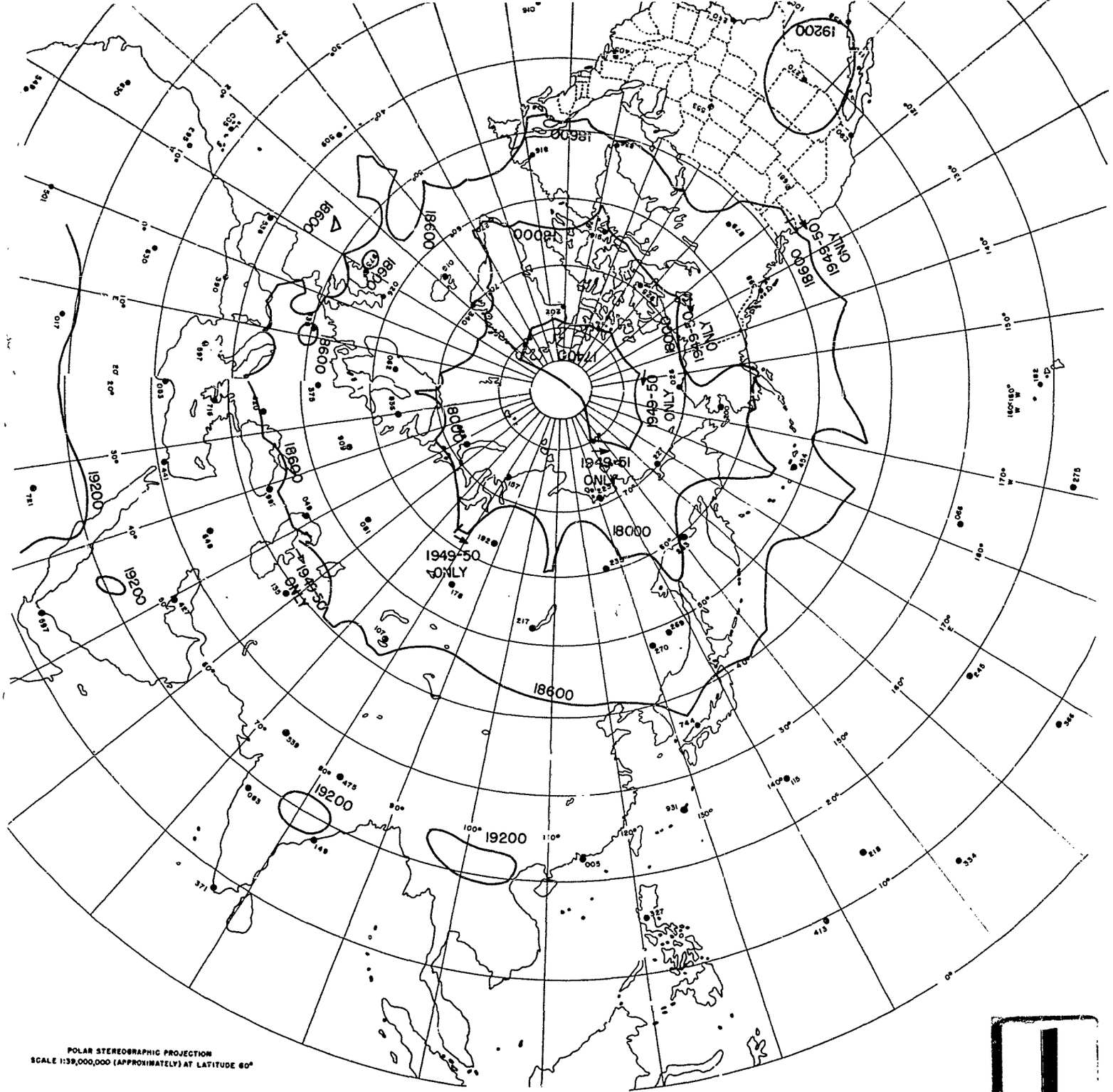
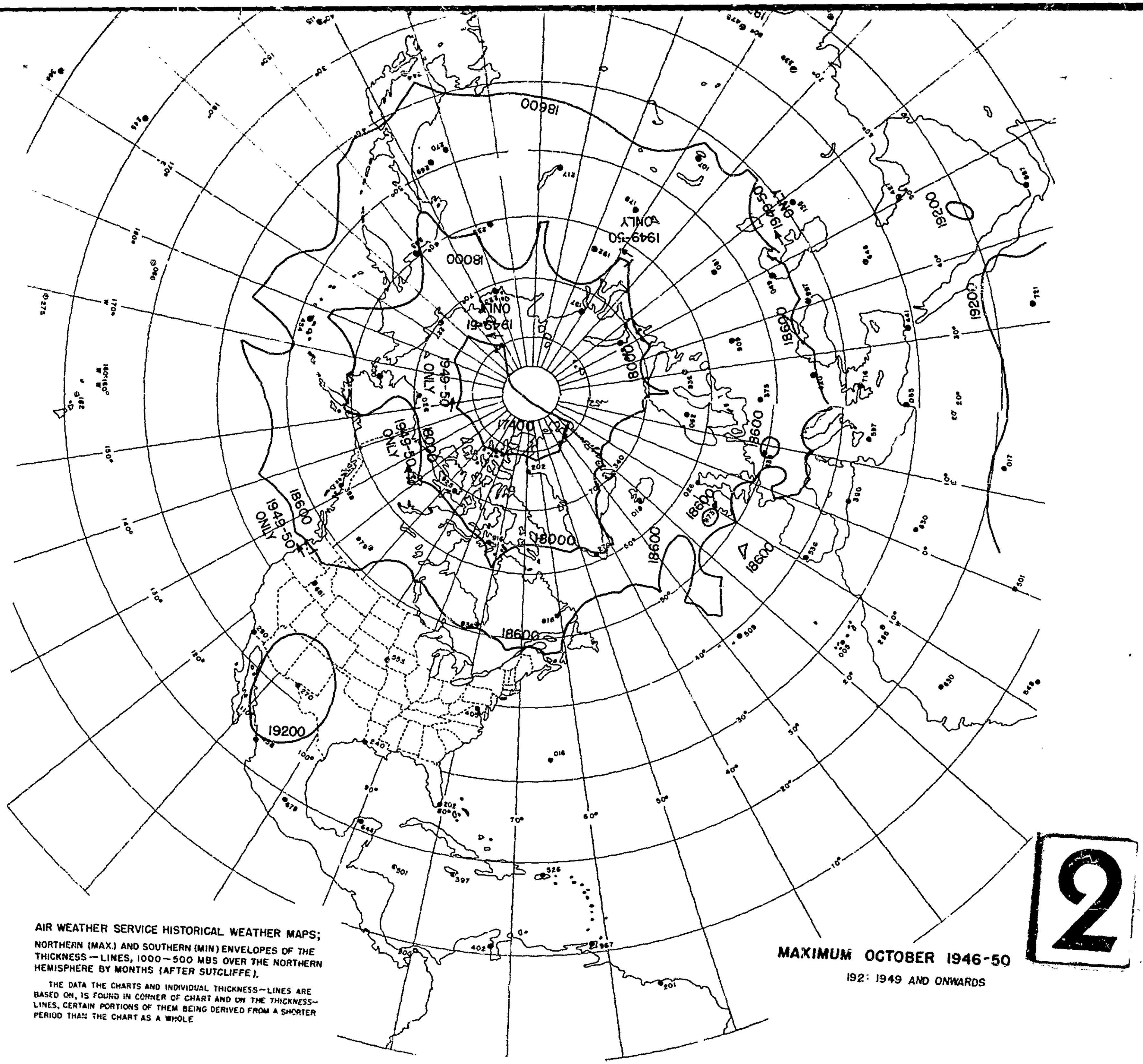
MINIMUM OCTOBER 1946-50

186: 1949 AND ONWARDS

162: 1949 AND ONWARDS

2


18600
19200
1949-50 ONLY
18000
POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°



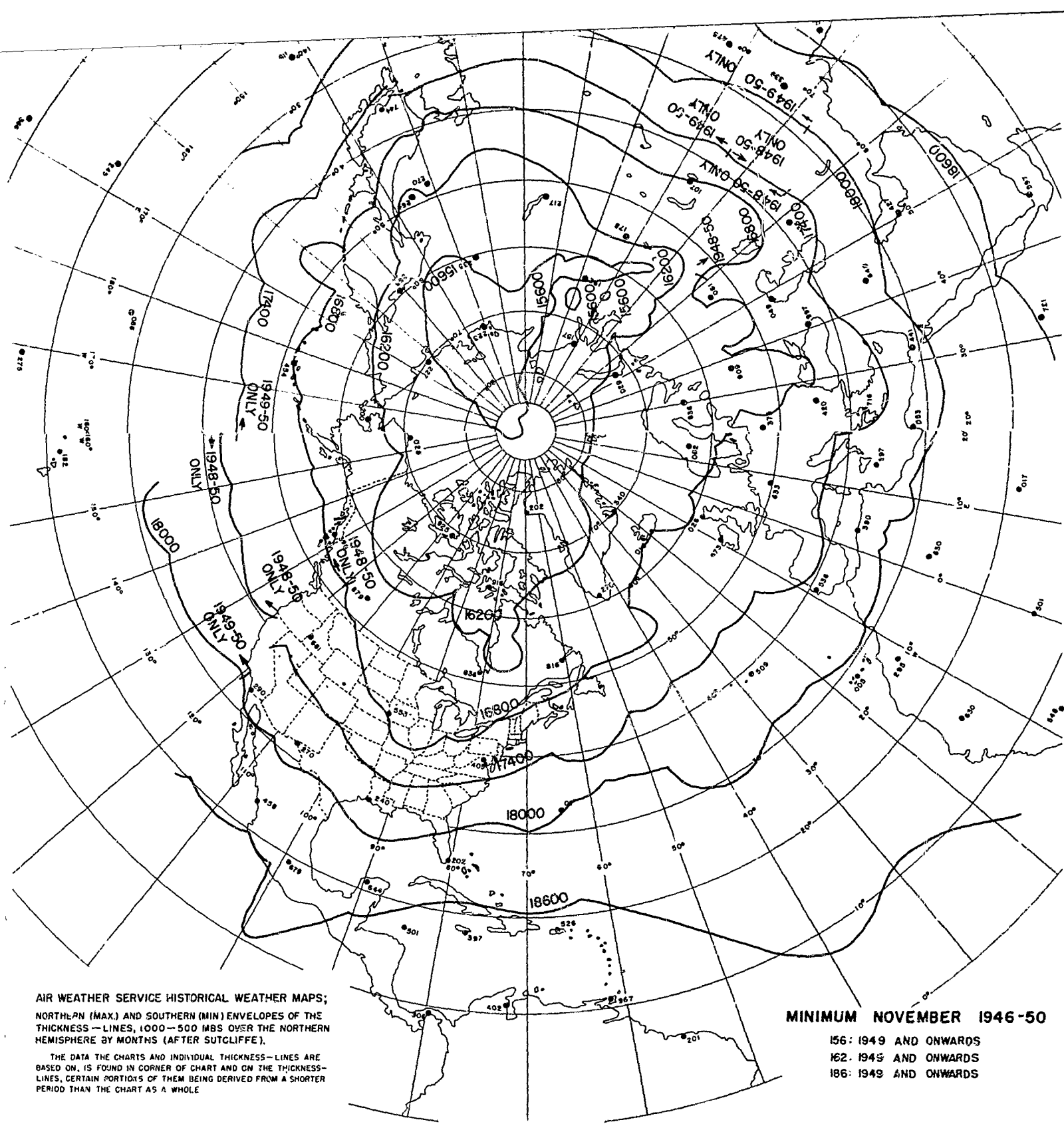
AIR WEATHER SERVICE HISTORICAL WEATHER MAPS;

NORTHERN (MAX.) AND SOUTHERN (MIN) ENVELOPES OF THE THICKNESS — LINES, 1000 — 500 MBS OVER THE NORTHERN HEMISPHERE BY MONTHS (AFTER SUTCLIFFE).

THE DATA THE CHARTS AND INDIVIDUAL THICKNESS—LINES ARE BASED ON, IS FOUND IN CORNER OF CHART AND ON THE THICKNESS—LINES, CERTAIN PORTIONS OF THEM BEING DERIVED FROM A SHORTER PERIOD THAN THE CHART AS A WHOLE

1

POLAR STEREOGRAPHIC PROJECTION
SCALE 1:35,000,000 (APPROXIMATELY) AT LATITUDE 63°
15600
16200
16800
17400
18000
1948-50 ONLY
1949-50 ONLY



AIR WEATHER SERVICE HISTORICAL WEATHER MAPS;

NORTHERN (MAX.) AND SOUTHERN (MIN.) ENVELOPES OF THE THICKNESS — LINES, 1000 — 500 MBS OVER THE NORTHERN HEMISPHERE BY MONTHS (AFTER SUTCLIFFE).

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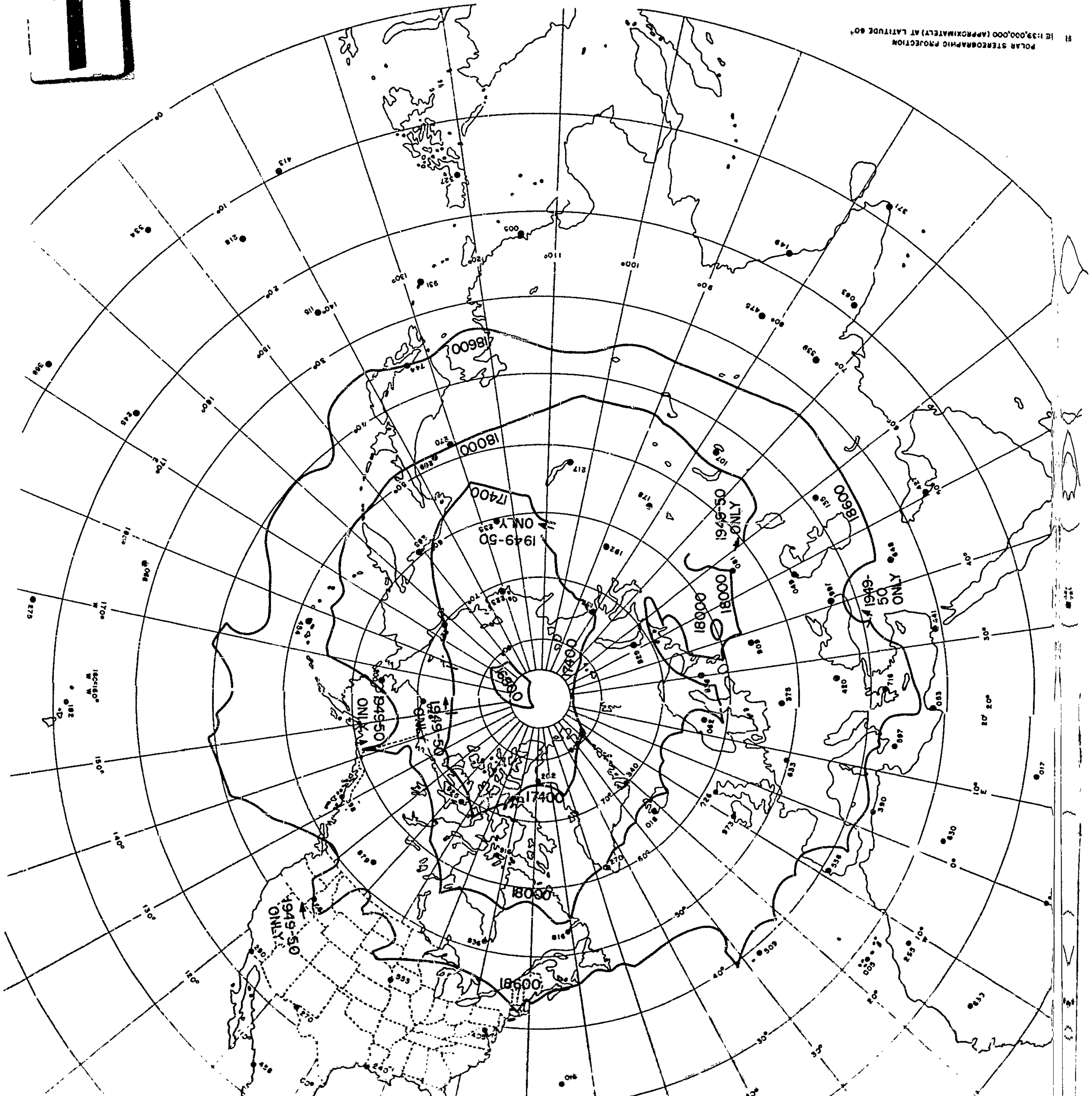
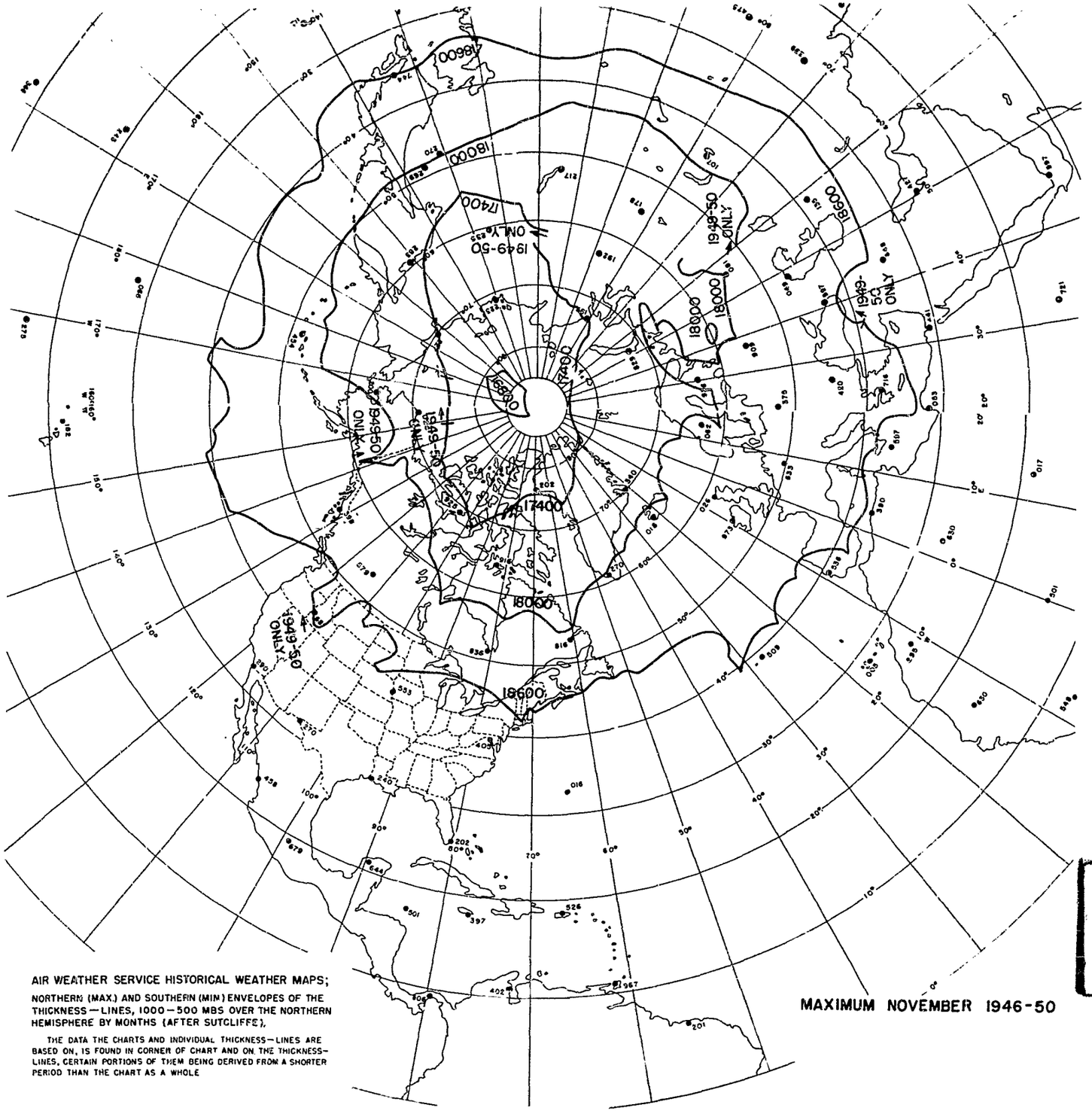
MINIMUM NOVEMBER 1946-50

156: 1949 AND ONWARDS
162. 1945 AND ONWARDS
186: 1949 AND ONWARDS

2

1





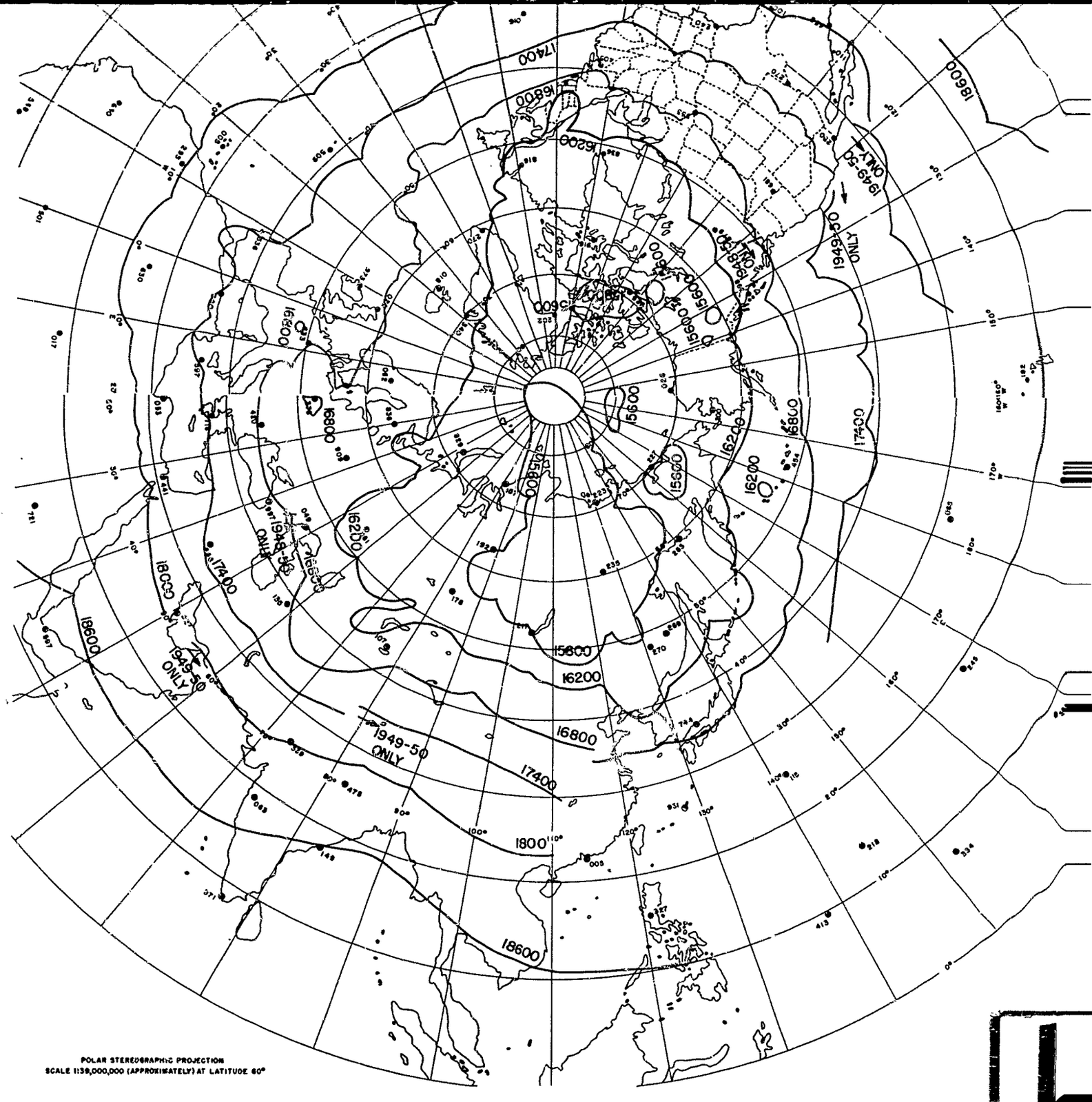
AIR WEATHER SERVICE HISTORICAL WEATHER MAPS;

NORTHERN (MAX.) AND SOUTHERN (MIN) ENVELOPES OF THE THICKNESS—LINES, 1000—500 MBS OVER THE NORTHERN HEMISPHERE BY MONTHS (AFTER SUTCLIFFE),

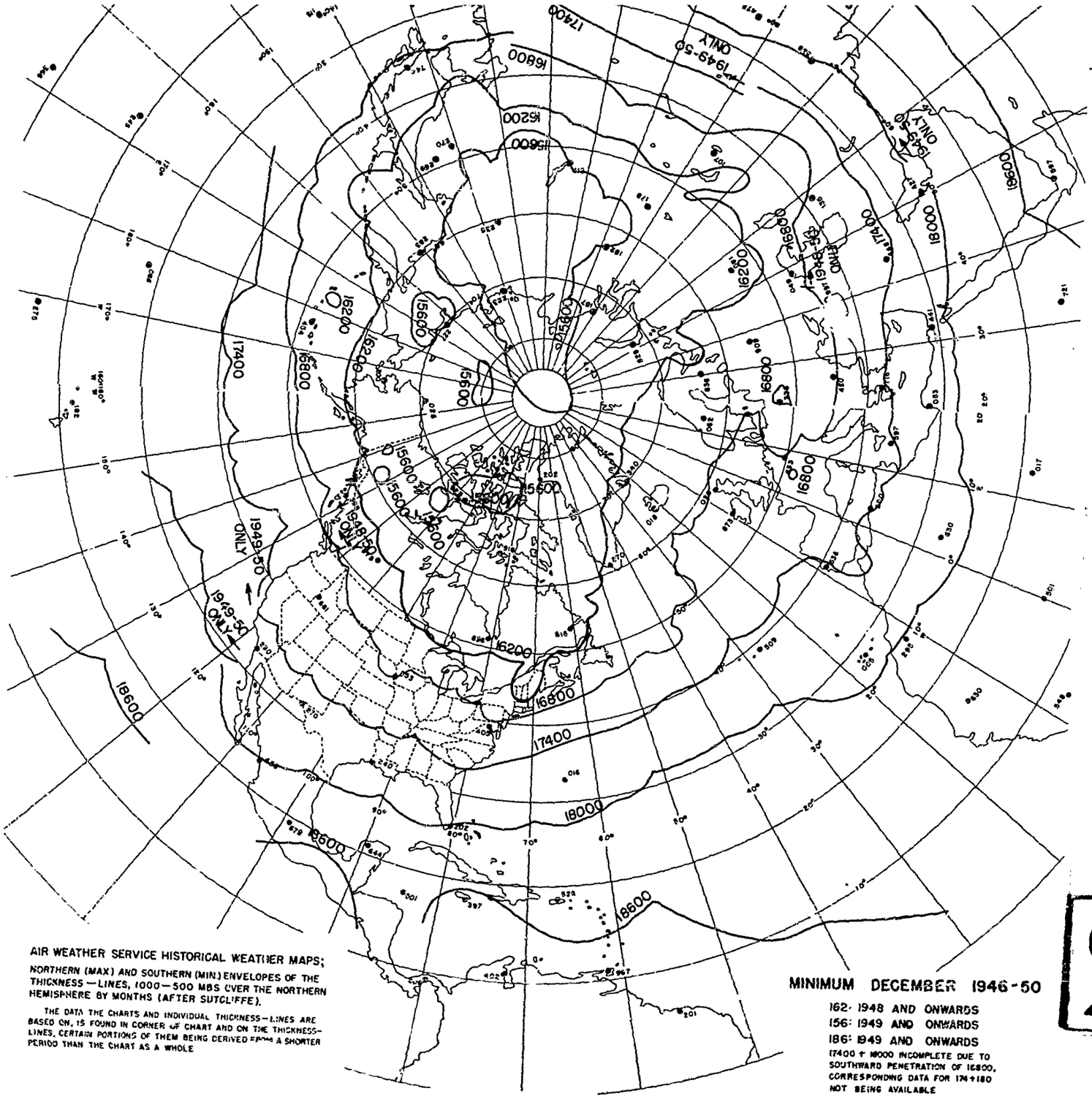
THE DATA THE CHARTS AND INDIVIDUAL THICKNESS—LINES ARE BASED ON, IS FOUND IN CORNER OF CHART AND ON THE THICKNESS-LINES, CERTAIN PORTIONS OF THEM BEING DERIVED FROM A SHORTER PERIOD THAN THE CHART AS A WHOLE

MAXIMUM NOVEMBER 1946-50

2



POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°



AIR WEATHER SERVICE HISTORICAL WEATHER MAPS;

NORTHERN (MAX) AND SOUTHERN (MIN) ENVELOPES OF THE THICKNESS—LINES, 1000—500 MBS OVER THE NORTHERN HEMISPHERE BY MONTHS (AFTER SUTCLIFFE).

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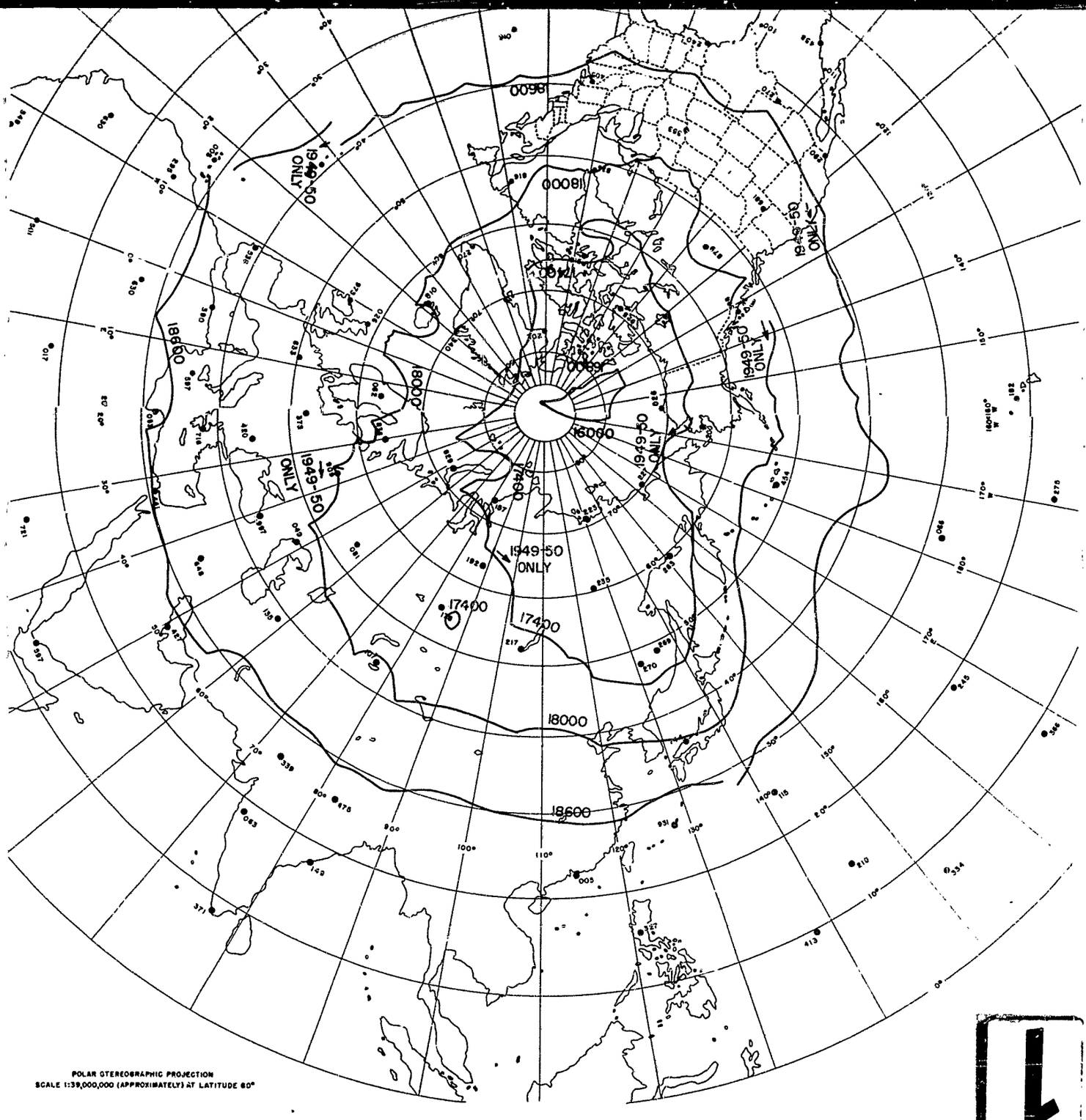
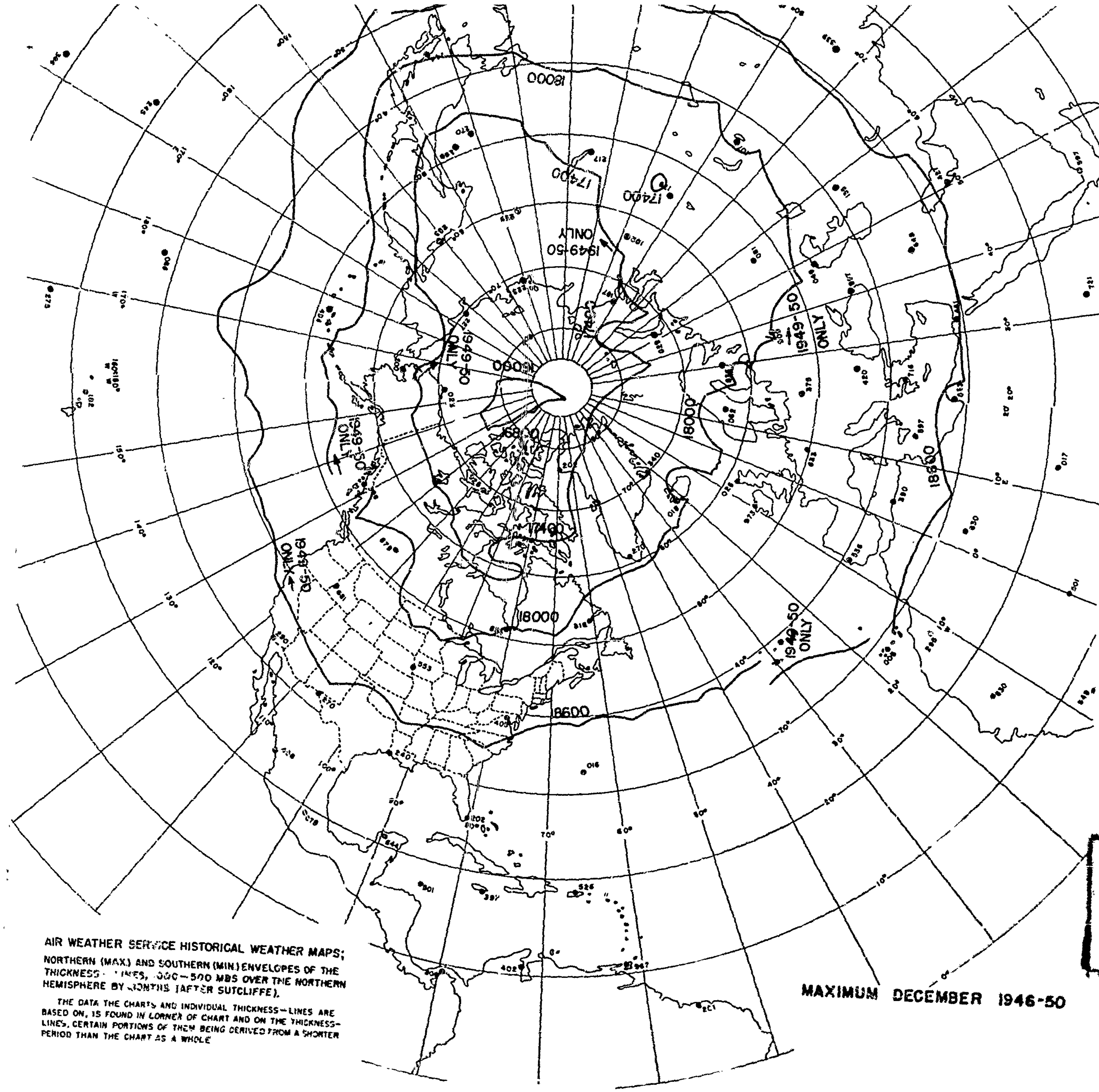
MINIMUM DECEMBER 1946-50

162: 1948 AND ONWARDS
156: 1949 AND ONWARDS
186: 1949 AND ONWARDS
17400 & 18000 INCOMPLETE DUE TO SOUTHWARD PENETRATION OF 16800, CORRESPONDING DATA FOR 174+180 NOT BEING AVAILABLE

2


18600
1949-50 ONLY
18000
1949-50 ONLY
18600
18000
1949-50 ONLY
16060
1949-50 ONLY
17400
1949-50 ONLY
17400
18000
18600
POLAR STEREOGRAPHIC PROJECTION
SCALE 1:39,000,000 (APPROXIMATELY) AT LATITUDE 60°

1



AIR WEATHER SERVICE HISTORICAL WEATHER MAPS;

NORTHERN (MAX.) AND SOUTHERN (MIN.) ENVELOPES OF THE THICKNESS [illegible] LINES, [illegible] — 500 MBS OVER THE NORTHERN HEMISPHERE BY [illegible] (AFTER SUTCLIFFE).

THE DATA THE CHARTS AND INDIVIDUAL THICKNESS—LINES ARE BASED ON, IS FOUND IN CORNER OF CHART AND ON THE THICKNESS-LINES, CERTAIN PORTIONS OF THEM BEING DERIVED FROM A SHORTER PERIOD THAN THE CHART AS A WHOLE

MAXIMUM DECEMBER 1946-50

2

DEPARTMENT OF THE AIR FORCE
AIR FORCE COMBAT CLIMATOLOGY CENTER (AFWA)
ASHEVILLE, NORTH CAROLINA 28801-5002

4 April 2006

MEMORANDUM FOR DTIC-OQ

ATTENTION: LARRY DOWNING
8725 JOHN J. KINGMAN ROAD
FORT BELVOIR, VA 22060-6218

FROM: Air Force Weather Technical Library
151 Patton Ave, Rm 120
Asheville, NC 28801-5002

SUBJECT: CHANGE CLASSIFICATION AND DISTRIBUTION STATEMENTS

1. AD353247 – Least dispersion of the Mark 12 re-entry vehicle, Sep 1964.

2. AD819674 – Climatic data summaries for selected Asian and Pacific stations; Republic of Vietnam stations, Apr 1967.

3. AD256922 – Bibliography of documents prepared by weather staff sections of Headquarters Army Air Corps and Headquarters Army Air Forces, 1937-June 1945, Apr 1961.

4. AD259710 – Technical publications and documents of Air Weather Service field activities, Part one: 1945-61 with a chronology of AWS organizations, 1945-61, June 1961.

5. AD156453 – Charts of maximum and minimum thickness lines 1000/500 MB, Northern hemisphere, 1946-1950, Sep 1952.

6. AD244550 – Technical publications and documents of Air Corps and AAF Field weather activities, Part two: 1937-1945 with a chronology of AC and AAF Weather regional organizations, 1937-1945, Sep 1960.

All the above documents need to be changed to "Approved for Public Release, Distribution Unlimited" please.

Susan A. Tarbell

SUSAN A. TARBELL
Librarian, Classified Custodian,
DTIC Point of Contact